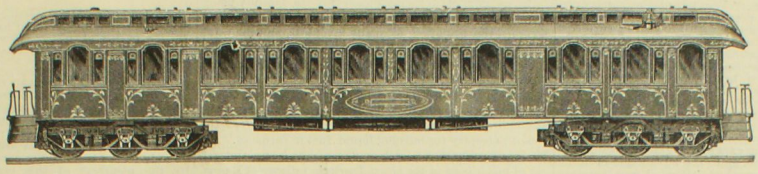
NATIONAL CAR AND LOCOMOTIVE BUILDER.



VOLUME XVIII. NUMBER 12. DECEMBER, 1887. SINGLE NUMBERS, TEN CENTS, $1.00 PER ANNUM.

Miscellaneous Items.

The Michigan Central road is building a lot of box cars of 50,000 pounds nominal capacity and 60,000 pounds real capacity.

The Indianapolis Car Works have contracted to build 300 cars for the Chicago, Burlington & Quincy road, 60,000 pounds capacity.

All the passenger equipment belonging to the Old Colony Railroad have 42-inch wheels; and although the drawing room cars are as heavy as any cars in use, they are all carried on four-wheel trucks.

The Decatur Car Wheel and Car Spring Co. has been organized at Decatur, Ala., and will build works which will have a capacity of 100 car wheels and a large quantity of car springs per day.

The Long Island Railroad, and also the Central of New Jersey, have adopted the Gold system for heating their passenger trains. Orders have been given to commence at once the work of equipping.

A company, to be known as the Continental Steel Car Wheel Co., of Norristown, is being organized at Norristown, Pa., for the manufacture of rolled steel car wheels, under letters patent issued to Theodore W. Bean.

It is reported that the Baltimore & Ohio Railroad Co. have concluded negotiations for the purchase of a large tract of land situated in Wheeling, W. Va., to be used in the erection of a large machine shop, roundhouse, etc.

The Kansas City Car and Wheel Works will be completed about the middle of December, and will give employment to 800 men. The estimated capacity of the works will be equal to the construction of ten freight cars a day.

The total number of passengers to and from Philadelphia, during the recent Constitutional Centennial, by all routes, was 706,396 for the three days of the celebration. Of this number 372,347 were transported by the Pennsylvania Railroad.

The Billmeyer & Small Co., York, Pa., are building 13 passenger coaches for the Norfolk & Western road. The coaches are of the latest Pennsylvania Railroad pattern. The company are also building a number of passenger and freight cars for South American roads.

The Harrisburg Car Manufacturing Co. are very busy in their wheel and car departments. Among the orders in hand for cars are 200 for the Union Tank Line, 250 hopper bottom coal cars of 60,000 pounds capacity for the Pennsylvania Railroad, and a large number for the Philadelphia & Reading.

The system of telegraphing to and from moving trains which has been established on the Lehigh Valley road was recently inspected by a number of well known railway officials, electricians and scientists. A special train, consisting of six passenger cars, was run from Jersey City to Easton and return, and numerous telegraphic messages were transmitted and received.

A newly invented car stove with a roaring fire in it has been dropped from the roof of a seven-story building in Chicago. The inside cylinders of the stove were shattered to pieces, but the heavy boiler-iron casing outside was not broken and no fire came out. Prominent railroad men in the city who witnessed the test expressed much confidence that the deadly car stoves were not all dead yet.

The Russian Minister of Railroads has appointed a commission to select a method of lighting railroad cars with electricity, and all the principal companies will hereafter be compelled to use the light on passenger trains. The South Russian Railroad has for some time used electric light on all its fast trains from Odessa to Kieff, and the Czar's special trains have been so lighted for a long time.

The Hoosac Tunnel Route is now operated as a double-track line to Johnsonville, N. Y., 175 miles from Boston, at which point the road diverges, one branch running south to Troy, the other west to Saratoga and Rotterdam Junction. Both of these branches are equipped with extremely long sidings, so that the Fitchburg road is practically double-tracked its entire length from Boston to its connections with the Delaware & Hudson, New York Central and West Shore roads.

The Chicago, Rock Island & Pacific Company have experienced so much annoyance from the destructive action of the journal collar of ordinary car axles that they are experimenting with plain journals. A lot of cars are under construction in the company's shops, at Chicago, and Mr. Verbryck has given orders that they be turned out without collars on the axles, the intention being to compare their performance in service with that of cars doing similar work, and having axles of the ordinary pattern.

A group of new locomotives recently built for the Chicago, Burlington & Northern Railroad are all equipped with the Cooke & Strong bell-ringer. This bell-ringer, which is the invention of Mr. Allen Cooke, master mechanic of the Chicago & Eastern Illinois Railroad, is of very simple form, can be worked either by steam or air, is never out of order and costs next to nothing for maintenance. This bell ringer is working rapidly into favor, and ought to be on every locomotive that runs through yards and over street crossings. Many suits for damages resulting from accidents caused where the bell was not rung would have been avoided by the use of this or some similar device.

The Connecticut River Railroad Company are erecting a new sixteen-stall roundhouse, at Springfield, Mass. The house is provided with all the newest improvements for facilitating running repairs, and for reducing the work necessary to get engines ready for the road. The house is very substantially built of brick laid on a substantial granite foundation. The roof is a light iron truss sixty-one feet long, giving over sixty feet clearance between the walls. The pits are built of stone with heavy granite caps to which the rails are bolted. The house is heated by pipes along the sides of the pits and excellent arrangements are provided for supplying water for washing and filling boilers.

The Martin coupler for connecting the pipes used for car heating possesses several features which ought strongly to commend its adoption by the railroad men now investigating the matter of a standard interchangeable coupler. It is entirely metallic, has an admirable form of universal joint which acts as a safety-valve in case of over pressure of steam and has been in use long enough to demonstrate tha it can be kept steam-tight without constant labor and attention. The coupler is also used on more cars than any other kind of steam connection, and has been adopted as the standard on the cars of several railroad companies.

We recently learned from Mr. Wm. Buchanan, of the New York Central, that they have already got the passenger cars for twenty-six trains equipped with the Martin continuous steam heater, and that no appearance of any hitch in the working of the system has yet been encountered. Before his company decided to adopt the continuous system of steam car heating, Mr. Buchanan subjected the cars equipped with the Martin heater last season to a test which was very significant. Without giving any previous notice of his intention, he ordered a train of the cars to be collected and the heating pipes coupled up. It was found that the whole thing worked perfectly, and that the steel couplings were all as tight as on the day they were first put on.

The experiments of the Pennsylvania Railroad Co. with heavy English steel rails and supports, to compare them with American rails and road-bed, will be carried on with two miles of these rails laid in half-mile sections. On the New York division the rails will be laid between Menlo Park and Metuchen; on the Philadelphia division, between Lemon Place and Kintzer's; on the Middle division, one mile east of Huntington; and on the Pittsburgh division, the rails will be put down on the eastern slope of the Alleghenies, near Allegrippas. The new rail will weigh 90 pounds to the yard, and they are to be tested for ten years. It is also reported that the company has ordered an English engine of the usual type for comparison with the American locomotive.

The well known "Point of Rocks" curve in the track of the Pennsylvania Railroad where it enters the Bergen Hill cut at the western extremity of Jersey City, has become a thing of the past. After grinding away rails and wheels and lurching people in the cars in a rude way for more than half a century, it has at last been circumvented by a nearly straight track, the recent construction of which completes the four-track cut through the rocky barrier of the hill. This great work was begun a dozen years ago. For the greater part of the way the cut is through solid rock and is nearly straight, bisecting lengthwise the old double track of the Camden & Amboy road, which was in the form of an S, and leaving it overgrown with grass and weeds. The completion of this great improvement is a boon to the traveling public, and an example of the progressive spirit which directs the management of this great corporation.

In his shops at Springfield, Mr. Underhill, of the Boston & Albany Railroad, is building some switching locomotives with cylinders 16 by 24 inches, and some heavy freight engines with cylinders 20 by 26 inches. Apart from the size of the cylinders of the latter, the engines have no special peculiarities except that the steam ports are very short and a coating of asbestos cloth is put above and below the boiler lagging. They are very busy with repairs in the shops. A great many of the old Eddy engines are in getting overhauled. These engines have slab frames bolted to the fire-box, and the provision for expansion is made by slotting the holes in the cylinder fastenings. It is hard to conceive how this ever came to be regarded as a good mechanical method. The frames of the engines require a great deal of repairing, due to strains put upon them by the expansion and contraction of the boiler. The stationary engine boilers of the works are using petroleum as fuel, fed by compressed air jets. It makes steam quite satisfactorily, but the odor of the oil is very strong.

Some time ago the Boston & Albany Railroad had a number of new passenger cars built, and the officers in charge conceived the idea that it would be a good plan to use tireless wheels in the middle of the six-wheel truck. Axles of the M. C. B. standard pattern were used. When the cars went into service it was found that no amount of care with lubrication would prevent the axle-boxes from running hot. It was found that the heating was caused by the side pressure exerted by the journal on the brass, the entire lateral thrust of the wheel having to be controlled there. Raoul axle-boxes were then tried, and it was expected that the stop-wedge would take the frictional strain off the journal, but it did not improve matters much, and they had to change the wheels and substitute flanged tires. The Chicago & Northwestern Railway people are running Mr. Scott's combination of axle-box with flangeless wheels successfully, but it may be that there will be trouble with the journal when the box wears sufficiently to let lateral motion of the wheel put heavy pressure upon the journal.

The promotion of Mr. F. D. Casanave to succeed Mr. Joseph Wood as superintendent of motive power of the Pittsburgh, Fort Wayne & Chicago portion of the Pennsylvania Company's roads, is a fitting recognition of the valuable services rendered for years by one of the ablest master mechanics in the employ of a corporation noted for the selection and development of able men. Mr. Casanave is recognized as one of the best posted men in the West on matters relating to rolling stock, and as a mechanician he has few equals, although his quiet unassuming ways tend to some extent to hide his merits from the notice of casual acquaintances. Those who have examined the methods of duplicating work in the Fort Wayne shops, and are familiar with the details of the piece work system in use there, readily agree that the systems are as perfect as anything of the kind ever put into practice; and it is further well known that the successful development of the systems was due to Mr. Casanave's mechanical and executive ability. Mr. Casanave has also written considerably on mechanical subjects, and in his hand the pen is as powerful as the engineer's tools.

Questions on Steam Engineering.

A correspondent writes: "You tell of the importance of retaining, as long as possible, the heat and other products of combustion in contact with the heating surfaces. Contracted exhaust orifices being necessary to free steaming locomotives, do you not agree that the engine run with a full throttle and cut back as far as possible consistent with the work required of her gains the three fold advantage of burning less coal, using less steam, and reducing the temperature of the smoke-box to its lowest possible degree over an engine working at 10 or 12 inches and throttled to do the same work? That also, as far as the draft, and retaining the heat in fire-box and flues is concerned, working steam expansively, and allowing it to escape at a low pressure, gains the advantages of large nozzles over an engine worked "down," and therefore exhausting steam of a higher pressure? I am not in doubt about the subject myself, but ask you to pass upon it more fully than you do in your book, because of a dispute." ENGINEER.

[Our correspondent answers his questions correctly, and as tersely as any one could do it. By running with the throttle full open and the links hooked back as far as possible, an engineer does a given amount of work with less steam than must be used by the man who throttles his engines and runs with the reverse lever a notch farther ahead. The first man takes all the work he possibly can by the expansive force of steam used; the second man does not utilize the expansion of steam to the best of his ability, and the steam passed through his cylinders will escape at a higher pressure than the steam used by the engine the first man is running. As the first man utilizes the expansive force of the steam, less of it is needed to do a given amount of work, therefore less water has to be evaporated, and a smaller quantity of coal will be required. As his steam escapes from the nozzle at a lower pressure than that used by the other, the draft will be milder and the products of combustion will pass through the flues at a lower velocity and therefore more of the heat will be imparted to the water. In this way an engine worked habitually as far hooked back as possible has an advantage equivalent to an enlarged nozzle over one which is habitually worked throttling.—EDITORS NATIONAL CAR AND LOCOMOTIVE BUILDER.]

Physical Tests of Materials.

The following are the tests that material supplied for locomotives under contract for the Missouri Pacific Rail way must stand:

All materials used in the construction of the locomotive shall be of the best quality of their respective kinds, carefully inspected and subjected to the following tests. Notwithstanding these tests, should any defects be developed in working, the corresponding part will be rejected.

Boiler and Fire-Box Steel.—A careful examination must be made of every sheet, and none to be accepted that show mechanical defects.

A test trip, taken lengthwise of the sheet and without annealing, should have a tensile strength of 55,000 pounds per square inch, and an elongation of 30 per cent., in section originally 2 inches long. Sheets will not be accepted if the test shows a tensile strength less than 50,000 pounds or greater than 65,000 pounds per square inch, nor if the elongation falls below 25 per cent. Should any sheet develop defects in working it will be rejected.

Iron or Steel Stay-Bolts and Boiler Braces.—Iron or steel for stay-bolts and braces must have an ultimate tensile strength of not more than 60,000 pounds, nor less than 46,000 pounds per square inch, with an elongation of not less than 20 per cent., nor undergo a reduction of area of fractured section of more than 35 per cent.

Boiler Tubes of Iron.—All boiler tubes must be carefully inspected and be free from pit-holes or other imperfections. Each tube must be subjected to an internal hydraulic pressure of not less than 500 pounds to the square inch by the manufacturers before delivery. They must be rolled accurately to gauge, filling the gauge to a plump fit. They must be expanded in the boiler without crack or flaw.

When tested, tubes must show a tensile strength of not less than 55,000 pounds per square inch, and a ductility of not less than 15 per cent.

Bar Iron.—All bar iron (flats, rounds and squares) must be capable of sustaining an ultimate stress of 48,000 pounds per square inch, with an elastic limit of 25,000 pounds, and a minimum ductility, measured by the elongation, of 20 per cent.

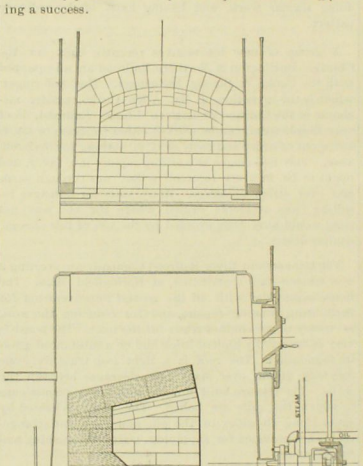
Electric Lighting and Windmills.

An exchange says: "Experiments are being made at Cap de la Hève, near the mouth of the Seine, on the production of electricity for lighthouse purposes by means of the force obtained by windmills. The suggestion to do so was made by the Duc de Feltre, and it is a system proposed by him that is to be tested. The wind works a dynamo-electric machine employed in charging accumulators of suitable capacity. The electricity so produced and stored is to be used at will to make a focus of light. The system, if successful, will have the advantage of costing only the putting up of the machinery. The whole question to be ascertained is whether a sufficient quantity of electricity can be stored to provide for the requirements of any particular station when there is no wind to move the sails of the mill. M. de l'Angle-Beaumanoir, a civil engineer at Paris, has been authorized by the Minister of Public Works to make, at the expense of that department, the trial of this system of electric lighting at the La Hève lighthouse."

It seems to us that a modification of this system, if it proves successful, might be applied to car lighting. The energy now dissipated by braking in approaching stopping points and in descending grades might be transformed into electricity without involving very complex mechanism.

Oil-Burning Fire-Box.

The problem of devising means for successfully using petroleum or its compounds as fuel for locomotives has occupied the attention of many inventors, and the want of success in this country has been due principally to the fact that coal was so cheap, that liquid fuel, although superior in many ways, was found to be more expensive than coal. In Russia coal is dear and petroleum is cheap, which brought round the conditions that encouraged the mechanical men interested to develop and perfect the means necessary for burning liquid fuel in furnaces. Mr. Thomas Urquhart, a Scotch engineer, who is superintendent of machinery of the Grazi-Tzaritzin railway of Russia, invented an arrangement by which he was able to use petroleum fuel in the locomotives on the railway where he has charge. As was mentioned in a former issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER, the Pennsylvania Railroad Compay some time ago sent one of their mechanical experts to investigate the system of liquid fuel burning devised by Mr. Urquhart, and they have been experimenting with a locomotive equipped with the same kind of apparatus. Mr. F. K. Hain, general manager of the elevated railroads of New York, on hearing what the Pennsylvania people were doing, concluded that the system of oil burning in locomotives had the possibilities of substantial advantages for the locomotives of the elevated railroads, where absence of sparks and dirt is of great consequence. He accordingly sent Mr. J. D. Campbell, his mechanical expert, to investigate the matter and ascertain how far the system was applicable to locomotives of the kind used on the elevated roads. The result of the inquiries was that the Elevated Railroad Company adapted the sytem, with some modifications, to one of their engines with every promise of the plan of liquid fuel burning proving a success.



The annexed cut illustrates the arrangement of the fire-box. A wall of fire-brick is built on the front and sides of the fire-box, and a layer of the same material is built at the back end on a level with the ordinary grate. The nozzles of two small injectors are placed immediately above this layer of brick, and throw the oil vapor on to the mass of brick in front. The flat layer of brick retains a storage of heat which vaporizes any oil which may drop from the nozzles. The arrangement is very simple and little subject to derangement. The engine equipped with this arrangement for burning oil was put to work during the busy portion of the day pulling passenger trains on the Third Avenue line, and she performed the work as well as any of the other engines that burn hard coal. She steamed quite freely, although the fireman had very limited experience, and it takes some time to learn how to manage the supply of oil and air properly. The officers of the road are satisfied that there is no difficulty about providing the mechanical requirements for burning oil successfully in locomotive fire-boxes; but it was found that oil as fuel was rather more expensive than hard coal. As there is no objection whatever to hard coal as fuel for elevated railroad locomotives, there is no reason for changing to oil, and for this reason alone the experiment is likely to end for the present the use of oil in the locomotives of the roads mentioned.

A correspondent who has recently obtained a position in the machinery department of a railroad writes to us as follows: "This road has at present about a thousand cars and twenty-nine engines, and the only machinery is a hand drill press and a grindstone. Yet we are building cars and rebuilding engines with these ancient facilities."

Western Railway Club.

CHICAGO, Nov. 16, 1887.

The regular monthly meeting of the Club was held at the Grand Pacific Hotel, Chicago, Nov. 16. President Rhodes in the chair. In the absence of Mr. Angus Sinclair, Mr. W. D. Crossman was elected temporary Secretary.

EXTENSION SMOKE-BOXES AND BRICK AND OTHER FIRE BOX ARCHES.

This subject was introduced by Mr. John Hickey, General Master Mechanic Milwaukee, Lake Shore & Western Railway Co. Mr. Hickey said: The subject of extension fronts and brick and other fire-box arches is one bearing directly on the large and important interests represented by the members of this club. To enter the subject deeply, however, would involve the discussion of many scientific points relating to combustion, and as these questions will be fully considered and submitted with a report based on the experience of many master mechanics a few months later, I will not at this time attempt to discuss the subject farther than its simplest bearings. Many ideas, different designs and opposing views of smoke box and smoke stack construction of locomotives is connected with their earliest history. To extract the full heating value of fuel, as well as to avoid by mechanical means the cinder and spark throwing and black smoke nuisance in locomotives has occupied the minds to a greater or lesser degree of all locomotive men. Patents without limit have been issued, and almost every conceivable device been introduced to modify the action of the blast in the smoke box sufficiently to admit a chemical combination of the fire-box gases, thus tending to perfect combustion, including the restriction of cinders and black smoke. To accomplish the ends spoken of and at the same time maintain blast that would develop heat to generate steam sufficiently to enable the locomotive to perform the necessary work within a given time is the problem to be solved. Saying nothing of the fact that a much larger grate area for locomotive fire-boxes than any now in general use would to a large extent cure many of the evils now complained of about fuel consumption and combustion, let us turn for a moment to the furnace of our present locomotives and see what elements we there meet. The fuel generally used is bituminous coal, a ton of 2,000 pounds of which contains on an average 1,600 pounds, or about 80 per cent. carbon, 100 pounds or 5 per cent. of hydrogen, and the remainder 300 pounds or 15 per cent. of oxygen, nitrogen, sulphur or other earthy matter. So far as relates to combustion, however, we are concerned principally with but two of these, namely, solid carbon, represented by coke, and hydrogen, generally known under the name of gas. These two elements contain principally the full heating qualities of the coal. Experiments have demonstrated that practically the gas from a ton of ordinary bituminous coal, or 5 per cent. of its makeup, requires 100,000 cubic feet of air for its proper or complete combustion, while the remaining carbon or 95 per cent. of its body requires but 200,000 cubic feet. Thus the gaseous matter of the coal requires one-half as much air as is required by the solid coke. It is an undisputed fact that the heating value of any combustible is exactly proportional to the quantity of air with which it will combine in combustion, hence the heating value of the gas is largely in excess of any other element of which the coal is compo-ed. It will now be seen that in order to get full heating value of bituminous coal, particularly on limited grate area, it must be handled with a degree of care that when firing accurate provision must be made to supply the necessary air for combustion of the generating gases, that the coal must be supplied to the fire with such regularity and carefulness as to permit this, that the artificial draft created by the exhaust will be such as not to attract the fire-box currents at too high a velocity, or that its attacks on the fire must not be such as to permit the admission of too much air, thereby cooling the gases below an igniting temperature and thus enable them, the cream of the coal, to escape unconsumed.

To improve the steps already taken towards economy of fuel the fire-box arch was invented and placed. Its position in the fire-box delayed to some extent the currents and gases after leaving the fire, and assisted largely their chemical combination and consequent combustion, before entering the flues. The fire-brick also become heated to an extent as to prevent the gases being readily cooled below an igniting temperature, as well as maintaining a more even and regular fire-box temperature. The extended smoke-box having a length from flue sheet to front end of about two and one-half times the stroke of the engine (not more) and a diameter equal to the circular part of the boiler is the twin sister of the fire-box arch, and while it is not claimed that directly its presence has any part in combustion, together with its attachments it has no inconsiderable part to play in connection with the struggling forces engaged in the fire-box, flues and smoke box of a locomotive when performing heavy service. The deflector plate, from its location in front of the flues, partly governs the heated currents arising from the fire and regulates their passage through the tubes. The wire netting placed below the exhaust nozzles, its mission being to restrict the exit of all cinders; the high exhaust nozzle delivering its currents into a straight, open stack, thereby creating in the smoke box a very regular and at least a good partial vacuum and manifesting its advantages on the fire by the reduced amount of black smoke emitted where these attachments are properly applied.

I will not tax your patience further in relating the many other advantages claimed by the advocates of the extension front and fire-box arches, but permit me before closing to say that I have found the expense of applying the extended front to locomotives to be $140 per engine, and after two years' service have noticed little if any wear of its attachments. The cost of applying the fire-brick arch, including labor and material, is with us $6, and its average wear is six months. The increased weight on the truck is caused by the application of the extended front is about 900 pounds.

Now, the subject has reached this point: Are the advantages claimed for the extended smoke box and fire-box arch real or imaginary? And, if advantages are admitted, are they sufficient to justify the expenditure of applying and maintaining the improvements? With the belief that a full, free and practical discussion of the subject amongst experienced men will elicit the information desired and establish the truth of disputed points, this imperfect and hurried review is respectfully submitted.

A Member: How is this 900 pounds of additional weight made up?

Mr. Hickey: The arch that we put on is much shorter than those in general use. As I have said, it is about two and one-half times the stroke of the engine. We find that to be about correct. Larger than that we find that the arch does not perform its mission as well as it does with a smaller arch. The sheet weighs about 500 pounds. Then we have 372 pounds of cast iron, and a few additional things bring it up to about 900 or 925 additional weight on the truck. That I include in the $140.

Mr. Swanson: Did you include the additional ring it is necessary to put in?

Mr. Hickey: Yes, but we don't weld it as we formerly did.

Mr. Shackford: Are you in a position to say that the good results obtained from the extension front are due to the extension? Have you ever tried the Wilson device?

Mr. Hickey: I have not tried the deflective plate with a short arch. I have tried the brick arch with a short smoke box.

Mr. Shackford: I mean the whole combination.

Mr. Hickey: No, I have not tried that, and I thought we could not get the results on account of having the diamond stack.

Mr. Mackenzie: What was your object in reducing the length of the extended arch, and what were the results of so doing? Was it to remove the sparks from the arch, or did you still intend to hold the sparks in the arch, as the extended front is intended, in the first place? I hear a good many stories of extension fronts running in this country where, when they get to the end of a run, and they open the door and find no sparks. My understanding of the extension front is that it is a receptacle for sparks. Now, if they don't hold them there, what is the use of them? And will you, Mr. Hickey, tell us why you make the arch two and a half times the length of the stroke?

Mr. Hickey: We found those proportions to be about the most economical. We had it larger and we had it smaller. With the larger arch the engine wouldn't steam, for the reason that there was so much more space there to create a partial vacuum, and I found by reducing it to that point to be the best point at which the engine would make steam and at the same time be easier on the fire. We are using a single nozzle, and we are carrying 4¼ to 4½ diameter for a 17-inch cylinder.

Mr. Mackenzie: I wanted to know whether you hold the sparks in your arch or whether you throw them out?

Mr. Hickey: We hold them all. I noticed the other day on an engine with extended front, going up a grade sixty feet to the mile, that she was working about 14 or 16 inches of steam, and I noticed that she didn't throw a single spark. It was after night, and I could see what she was doing. There didn't a single spark come out that I could see in that two miles and a half that I was looking. We retain them in the smoke arch, and when they stop at a point for water or at some convenient place they dump them.

Mr. Verbryck: I am not an engineman, Mr. President, but still would like to say a word in this connection. Mr. Hickey claims that the extended smoke arch catches all his cinders. The other day I was on the Illinois Central road, going up to Pullman, and they had an extended smoke arch on the engine. I don't know whether they caught all the cinders or not, but I thought it was hailing on the cars. Our General Master Mechanic is decidedly opposed to the extended smoke arch, and I would like to know where the advantage is, seeing that we do not use it on our road, and the statements of our General Master Mechanic as to fuel and the performance of engines compares favorably with any road that uses the smoke arch.

The President: I would like to ask Mr. Rosing, of the Illinois Central, whether he can account for that hail that Mr. Verbryck speaks about on the top of the cars?

Mr. Rosing: The only way that I can account for it is that the engine had probably made the round trip without having the arch emptied. I ride on those cars every day myself, and I do not find that they throw many sparks, that is, if they have had time to empty the box. With engines running at every ten minutes they can not always get the attention they require. The only way that I can account for it is that the engine was not cleaned out at the end of the trip.

Mr. Hickey: Mr. Verbryck spoke about the cinders raining like hail on the cars; did he mean to say that the engine was equipped with an extended front? We all know that usually a diamond stack engine, with a sharp exhaust, will do that, and it is possible it was an engine equipped with a sharp arch; and there is one of the advantages of the extended front. In the case you speak of, Mr. Verbryck, with a diamond stack the cone and netting are above the exhaust, while with the extended front the cone and netting are below the exhaust.

Mr. Verbryck: But this one had an extended front.

Mr. Hickey: Then there was something wrong with the netting or some other appliance.

Mr. Wm. Forsyth: I should like to ask Mr. Hickey how he arrived at the rule for the length of the extension front, and what relation exists between the length of the stroke of the piston and the length of the extension front. We have various sizes of cylinders, and certainly an extension front that would answer for one size would not be proper for another. It seems to me that the rule should be based upon the boiler part, the furnace and that part where the combustion takes place, rather than the steam portion of the locomotive. I should say that the length of the extension should be inversely to the area of grate.

Mr. Hickey: As the paper states, I think that sufficient grate area in our locomotives would almost cure all the evils that we aim at in our extension front; if we were able to put in grate surface enough, I think we should not need the extension front. We use the arch to enable us to secure the cream of the coal. The extended front was used for two reasons. It was well known years ago that engines with a very small arch were very hard to fire, for the reason that there was not space enough in the front end to create a regular draft on the fire-box; and we introduced the front end for the reason that it would enable us to get a more perfect draw on the fire, and be easier on the fire; and, in the next place, it answered as a receptacle for sparks. We struck on the length named after building them larger and smaller. I found out that it was just about two and a half times the stroke of our engines, and I settled upon that; but, as Mr. Forsythe says, it should be in proportion to the grate area. I believe that is true. I believe if we could get sufficient grate area it would put an end to the whole trouble. We all know that we have had very imperfect combustion, but with the extended front, with a large arch and fire-box in connection with it, we certainly do away with a great deal of it. The extended front is also noticeable at once in the lesser amount of black smoke.

Mr. Shackford, Chicago & Alton: It seems to me, Mr. President, that the extension front end is merely a receptacle for the cinders, and while an engine equipped with the extended front throws less fire before she is filled up in front, the moment she is filled up throws just as much fire as with an ordinary front. We have experimented a good deal on the Alton road in this matter. We have used extension fronts and various devices. The device of Mr. Wilson (illustrated in the NATIONAL CAR AND LOCOMOTIVE BUILDER for October) can be easily applied to any ordinary front end at a great deal less cost than an extension, will be a less weight on the truck, and will throw less fire than any extension front end I have ever seen.

Mr. Mackenzie: Is the device you speak of any thing more than a receptacle for the sparks? We have been using the common arch, with a basket netting in connection with the brick arch, which is decidedly saving on fuel and the admission of sparks, but it doesn't begin to hold all the sparks that come out of the fire-box. What I want to get at is something that won't throw any sparks. If the extension front will do it that is the thing to use, in my opinion.

Mr. Shackford: I would extend an invitation to Mr. Mackenzie to ride behind one of our engines, and I shall be very much surprised if he succeeds in catching any sparks.

Mr. Swanston: We have had what we think very good results from the ordinary extension front with the brick arch, but I have always thought, and my experience has been that a few two-inch tubes, placed above the fire—four or five, according to the length of the fire-box—very materially improves the consumption of the black smoke and allows the air to ignite with the gases. That is in combination with the brick arch.

Mr. Hickey: I have tried the tubes that Mr. Swanston speaks of, but I find that the admission of air has got to be in proportion to the amount of fuel used. If too much air is permitted to go into the fire-box, the result is of course a reduction of black smoke, because it materially does away with the current; but, at the same time, if too much of it is permitted to enter it reduces the temperature of the fire-box and calls for so much more fuel to bring up the heat.

Mr. Mackenzie: You have all probably read of a device used on the Holbrook Company's line, where they extend the arch back of the front axle, and every time the throttle is closed the sparks pass out of a pipe. We have tried one engine with that, and it was a failure with us.

The President: I would like to give you, gentlemen, a little of the experience we have had on the C., B. & Q.; not that I think it is very valuable, but what we want is to get the experience of the different members. I have recently made a trip over our road, which, as you know, extends as far as the Missouri River, and in going over that territory we meet with quite a variety of fuel. The Illinois fuel is not the best, but the Iowa fuel is very poor. It seems to me that this matter of grates and fronts is almost inseparably connected with the kind of fuel you use. We recently gave orders that our engines should be fitted with the extended fronts, not because we liked the extended front, but because of our diamond tops, and we didn't know any way to prevent the throwing of the sparks. Out in Iowa our engines have been steaming so badly that I sent out an order that no more engines were to be fitted up with extension fronts. Going over the road in Illinois all our master mechanics are quite in favor of extension fronts. Seventeen-inch cylinders and 18-inch cylinders run with four and five-eighths single nozzle, in Illinois, and the engines steam well with them. We have been running our 17-inch cylinders, freight engines, with four and three-quarter nozzles all summer. Just now, on account of engines not steaming so well during the winter months, one of our master mechanics said he was reducing his nozzles from four and three-quarters to four and five-eighths, still showing quite a large nozzle. Out in Iowa the single nozzle on the same engines is down to four inches. I was talking with one of our traveling engineers, and asked him about the amount of fire that these engines threw in Illinois. He told me that they didn't throw any fire at all—practically what Mr. Hickey says. But out in Iowa it seems entirely different. The grades there are more severe than they are here. In Illinois we are comparatively level; in Iowa they are up and down hill. The consequence is that the engines are worked more at full stroke. One of our traveling engineers told me that in Iowa they threw fire very high and blew it clear out into the fields, and there was not much benefit from the extension front, so far as fire was concerned, out in Iowa. I had hoped there would be some representative present from the B., C. R. & N. road. Some couple of years ago, if my information is correct, that road was equipped almost entirely with diamond tops, but on account of the fires they had the diamond tops were removed, and I believe their engines are now equipped exclusively with extended fronts. It would be interesting to know whether the fires on that road during the last year have been much less than they were during previous years. As to Mr. Hickey's statement that these extension fronts were merely a makeshift for grate area, and that the proper way to do away with the sparks was in the grates of our engines, that if we had the proper grate area we would need no extension front, no cone, no netting, I am quite prepared to indorse. If any clear evidence of it should be wanted we have it on the Chicago, Burlington & Quincy road. We have two engines running that have all the grate surface that is necessary. We run the smoke-box without any cone, without any netting, and we get no sparks out whatever. Those engines have never been accused of setting any fire. They are fitted with the Wootten fire-box, and used with a very low grade of fuel. You will ask, probably, if these Wootten engines do the work so thoroughly why do we not have more of them. The reason is partly that our experiments are not thoroughly completed. In the first place we find the fire-box, constructed as these engines are, to be very expensive to maintain. The fire-box doesn't last any length of time; we have to renew them constantly. Further than that, the ordinary fuel, such as we get in Iowa, the ordinary lump fuel, the engines won't steam with. If you use that lump fuel in such a large grate surface you cannot stop up the air passages, there are too large openings among the large lumps of coal, so that the engines won't steam; but when you take this same fuel and crush it the engines steam remarkably well and without sparks and hardly any smoke. But it is almost impracticable to use the engines in that way. You cannot get the fuel. The engines won't steam with the lump fuel, and you cannot get a sufficient quantity of this pea coal, as it is called, screenings, to supply the demand for freight engines on a road like the C., B. & Q. I think, then, that in taking up this matter of extension front it is going to be vital with us to consider the kind of fuel that we use.

Discussion closed.

RELATIVE STRENGTH OF SAP AND HEART IN NORWAY PINE.

Mr. W. L. Brown, Chemist Chicago, Burlington & Quincy R. R., read a paper on this subject, and especially relating to sills of freight cars. The paper contained numerous drawings, diagrams, statistics, etc., rendering it impossible to be reproduced at present.

DISCUSSION ON MR. BROWN'S PAPER.

Mr. Hickey: How are the relative strengths of Norway and Georgia pine for stringers recorded, as to strength and durability?

Mr. Brown: We made no experiments on the Southern pine. All I could give would be the testimony of others. I have looked it up in the Government report, which shows that the yellow pine is much the stronger. As to durability it is not stated. But the general testimony is that it is much stronger.

Mr. Verbryck: That is directly contrary to the statements made some time ago by Mr. Davenport. His experiments showed that the Norway was some 33 per cent., or in that neighborhood, stronger than the Southern pine. He published at the time a report showing the various experiments he made.

Mr. Hickey: What has been your experience, Mr. Verbryck, as to the relative values of Norway and Southern pine for stringers for cars?

Mr. Verbryck: When I was East, on the Erie Road, we used to use the long leaf pine altogether for stringers for cars, and in the latter part of my stay there we used it for the frames of cars also. I believe if you take the long leaf yellow Southern pine, and if you get wood that has not been tapped for the turpentine, it is very much more durable than the Norway pine; but I have never used any of it of any account since I have been West. I have used the Norway pine altogether for the last sixteen or seventeen years, and I have had very good success with it. I remember a good many years ago, when I was on the Erie road, we had a lumber yard, and we used to use this Southern pine, and there were pieces of it cut off and put down in the lumber yard for blocking, and when they broke up the yard I found blocks that had lain there for twenty odd years, and were just as sound as could be. They were all full of turpentine. But the sap of the long leaf pine will rot just as quick as the Norway will, but if you get the heart full of turpentine, it is very durable. I don't believe it will ever rot, if it is like some that I have seen.

Mr. Brown: It should be borne in mind how the Norway pine will splinter, while the Southern pine keeps a smooth surface all the time.

The President: I would like to make one statement about this test, to explain what brought it about. The sills on one of our connecting lines were breaking, and we took the matter up with those in authority of the connecting road, and they explained to us that the sills were Norway pine, that the standard of the road was Southern pine, but that in common with the practice out in the West some of the Western shops had built the cars of Norway pine. It then seemed wise in building cars to consider the kind of wood of which we were building them, the same as putting in iron you consider the kind of iron or whether you will put steel in, and it would seem to argue also that if sills of a certain kind of material were of certain proportions, if you used a different kind of material you might have to change your proportions entirely. Also we all know the difficulty of getting heart sills; the tendency is to get the bulk of the sill of sap, and it raised the question whether or not we were getting our sills weak by getting the sap. We knew how it rotted, and was therefore objectionable, and we also thought it might be possible we were losing the strength of our sills by getting so much sap. I think this investigation will satisfy us all that we are not losing strength by the sap until it begins to decay. I think perhaps the most interesting part of this whole question is the statement in the report that the seasoned sill is almost double the strength of the green sill. It seems to me that this is vital, for we know that many of the cars that are now being built are built almost entirely of green lumber, and the most difficult thing the car builders have to contend with is to get the manufacturers to have seasoned lumber.

Mr. Verbryck: I would just like to say further about the relative merits of the Southern and Norway pine that I think I had just as many cars break off, the sills break, with the Southern pine as I have ever had in the West with the Norway pine, and the principal cause of that was the old-fashioned wooden bolster. The old way of framing was to put truss rods through, bore through the intermediate sills, and throw the truss rods over the draw sills, and there was the only trouble I ever had with sills breaking. Since we have used the iron transoms we have had but little trouble with broken sills.

Mr. Schroyer: As regards Norway pine, there are a number of objections I have to it. One is that the sap is more liable to decay than any other one wood that I know of. Why it is I am not able to tell, but I know it is a soft, spongy, fibrous wood, and it will absorb more water than any other wood that I know of. That is one reason why it will decay so quickly. But it is also very liable to what we call dry rot; that is, it will commence to decay at a point where it is not exposed to any dampness. It is more liable to dry rot than any other wood I know. It is more liable to have large thin knots in it than any other wood I know of, with the exception, perhaps, of some one or two of our Northern woods. I have had more experience with the Southern pine than I have had with this Norway pine. I favor Southern pine because I believe it is a better wood, a more lasting wood. Southern pine that has been bled and the turpentine taken out of it has, of course, lost part of its life and strength, but even then I consider it equal to Norway pine.

The President: Does the Northwestern road use Norway pine or yellow pine?

Mr. Schroyer: They use the yellow pine, and have for a number of years.

On motion of Mr. Swanston the subject was closed, and

a vote of thanks tendered Mr. Brown for his interesting paper.

On motion the subject of Standard Axle for 60,000-pound Car, laid on the table at last meeting, was then taken up.

Mr. J. N. Barr: My idea, Mr. President, has been that if we took the Master Car-Builders' axle, with a 7 inch journal, as it exists to-day, and increase the size of the axle and the size of the journal, say, the journal to four inches, we would then have an axle that would carry the load. The thickness might be slightly out of proportion to the length, but after your 4 inch journal had worn down to three and three-quarters you would still have a good 40,000-pound M. C. B. axle. It seems to me that for years and years we are going to run 40,000-pound cars, and we going to have 40,000-pound axles, and the proposed 60,000-pound axles are such that can not be readily utilized afterwards in our existing construction, and it seems to me that that is an important subject to be taken into consideration. I have had some little experience with journals 8 by 3½ under passenger cars, and they have given trouble by breaking. I can not say that it was the additional length that produced the result, but I am inclined to think that that had something to do with it, and now if an 8-inch journal is adopted, I think we ought to have the center of our journals the same distance as the M. C. B. standard. My idea at present is that we ought to increase the diameter of the M. C. B. axle, just as it exists, to meet the requirements of 60,000-pound cars, and then we would have it in use afterwards, having plenty of places in which we could use it.

Mr. Schroyer: Mr. President, I recognize the wisdom of the remarks of Mr. Barr, if that idea could be carried out. If we increase the diameter of the present journal, keeping it the length that it now is, we shall increase the load carried on that brass 91 pounds and two-thirds per square inch. We not only increase the load carried per square inch but we increase the friction under speed. We now make about 615 revolutions per mile, and the circumference of our journals is, I think, $11\frac{5}{16}$. Multiply that by 650 and you get the distance in feet and inches that your journal travels every mile under the brass. Now, if you increase to four inches you increase your circumference, and in addition to increasing under the load carried you also increase in friction at the same time, and I am very much afraid that if you increase in both of those places you will have hot journals continually, and having hot journals you are going to have broken journals. I am favorable to still retain the 6 feet 3 inches from center to center. I would not under any circumstance, unless they were such as could not possibly be avoided, be favorable to increasing that length. Regarding the use of the journal proposed, after it has once done service under a 60,000 pound car we could construct a brass or a wedge, or use our common wedged brasses, as we now use them in the present truck, in the same box, and still avoid having a collar on the journal. The out-side length of the journal in the boxes we are now using will not cut any figure in this at all, because the length of the journal proposed is just the length of our present journals. The only difference will be that it will not have the outside journal to take the thrust, which is claimed to be taken there. We can make our plate thicker to take the thrust, and take part of the thrust on the back end instead of the fore. So far as a collarless journal is concerned, I am favorable to a collarless journal myself, but I have not talked with any of my superior officers on this subject. I am not prepared to say "take a collarless journal" until I know what they think about it.

Mr. Swanston: I believe that the distance between centers should not be increased. I think the tendency to spring is very largely increased as soon as you begin to extend the length beyond the present limit. In fact it now stands with the 40,000-pound car—there is no doubt about that—and I think that it is more the cause of hot journals than the actual amount of friction. I think the axle should be 4½ for a 60,000-pound journal, but I would like to keep the centers the same as with the 7-inch journal. But I have hardly given this subject sufficient attention to recommend any thing.

Mr. Wm. Forsyth: At our last meeting there was some objection made to our present 8-inch journal, for the reason that it would make the distance between the hub and the back of the box too small for a good dust guard. I have had a drawing prepared, which is here, showing that with a collarless journal eight inches long, and a distance between centres of journal 6 feet 3 inches, we could obtain a space of $\frac{8}{8}$ of an inch. The present standard is $\frac{5}{8}$ of an inch, and the testimony at the last meeting was in favor of reducing this distance.

Mr. Hickey moved that a committee of three be appointed by the Chair to recommend the proper sizes of car axle for a 50,000 and 60,000-pound car, and at the same time to express its recommendations whether they would adopt a collarless axle or not; also to determine whether they can maintain the original length between centers of journals according to the old M. C. B. standard. Seconded and carried unanimously.

The Chairman appointed as members of this committee Messrs. Verbryck, Shroyer and Hickey.

A motion was carried directing Secretary Sinclair to request the Wagner Palace Car Company to appoint a representative to the joint committees on a standard coupler for car heating.

Adjourned.

New England Railroad Club.

The regular meeting of the club was held in Boston, Nov. 9, President Lauder in the chair, the subjects for discussion being

CAR AXLES, BEARINGS AND LUBRICATION.

The President said: We are making rapid strides in the direction of heavier cars, freight cars especially, heavier loads and higher rates of speed, and we shall soon have to enlarge our car axles, journals included, and if so, the Master Car-Builders' Association should be urged to adopt a larger standard. The Westinghouse testing train, to which allusion had been made, consisted of 50 cars, weighing 15 tons each. Each car will be loaded with not less than 60,000 pounds, making 45 tons, sustained on eight small journals. We must have larger axles for safety. [He then exhibited a drawing of a proposed larger axle, without changing materially the present standards of journal boxes.]

Mr. Marden (Fitchburg R. R.): When the Association adopted the present standard they did not go far enough. We have been ordering axles 4¼ inches in diameter in the middle for some time, which is not too large for the present size of journal. The journal should be at least 4 inches in diameter and 8 inches long, and the axle should be at least 4½ inches diameter at the center. The present length of axle should not be increased.

Mr. Coney: For the last 40 years axles have been made of scrap iron. Thirty years ago, the best axles were said to have been made of horseshoes, supposed to be Norway and Swedish iron. To-day scrap axles are made for 2¼ cents a pound. "Scrap" is anything a forgeman sees fit to buy. The government years ago used to call for rods and shafts made of fagoted bar—a bar of iron in the center and other bars around it drawn down with the hammer. An axle made of promiscuous scrap bought here and there, you cannot tell much about. One made of fagoted bar, of which you know the tensile strength and know that the iron is homogeneous throughout, is one that you can rely upon. In some tests of axles going on at the Watertown Arsenal they find that the best axle is made of horseshoes, and has a tensile strength of 70,000 pounds; some have 42,000, some 55,000. You cannot make 100 axles of scrap iron and have them alike, but if you make a fagoted axle you know just what you have got. Thirty years ago we made axles in this country with 3½ in. journals for cars carrying ten tons or less. Now we are building cars for carrying 20 tons, and use 3½ in. axles, which are not large enough for safety. What we want is an axle safe enough to carry any load.

Railroads now use an oil that allows 30 per cent. more friction than an oil which can be had at a little higher cost. In order to run a railroad to the best advantage, the best materials should be procured, the best axles, the best composition of metal for boxes, and the best lubricators.

The President: I have put on to the blackboard a diagram of an axle in operation, designed by Mr. Johann, of the Texas & Pacific road. It will fit into the Master Car-Builders' box, the internal arrangements of the two being the same. There is no key, none being necessary. The journal is 4½ inches diameter, beyond question as to strength. This axle can be used without changing any existing standard, and will carry any existing load. We have one very heavy tender running on that journal, and it has done admirably so far.

I will introduce to you Mr. Webber, who was formerly connected with the Chicago, Burlington & Quincy, and is now a mechanical engineer in Boston.

Mr. Webber: The Chicago, Burlington & Quincy has taken up the subject of axles, especially scrap axles, and made many experiments. Their method of making a test was to inspect a carload of axles, to reject such as had flaws in them that showed, and to take two from every 50 of the remainder and test them first by a falling weight, and then by cutting sections through the center of the journal, then etching them with acid and printing from them. I have some of these prints here, which tell the whole story. Here is one taken from a piece of scrap axle; that shows the texture of the axle, the holes and imperfect places, the acid having eaten through the dirt and other impurities and left the iron. There is a print from a steel one, showing very little impurity. This led to using greater care in the selection of the scrap and more thorough working of the axle. There is a print from an axle made of well-selected scrap, and very thoroughly worked, and the difference between that and a print from an ordinary axle is very perceptible. There are two made from new bar iron, fagoted iron. There are two prints from different parts of the same axle, one from the center, which was worked the most, showing that working the metal has a tendency to refine it and bring it up more solid. There were also tests by bending, which we considered a good test, as also that by a falling weight. It was found that the best scrap-iron axle, that would stand the Pennsylvania Railroad test while it was warm from the test, if allowed to cool and apparently get rigid, would break at the first drop afterward. It was not so with steel axles at all, which could not be broken under the drop.

Mr. Shinn: Suppose you got rigidity in your axle by enlarging it, what would that element be worth if you increased your resistance to bending, say 25 per cent., what would be the difference in the value of your axle theoretically?

Mr. Webber: I should think the larger axle would be better than the smaller axle of higher tensile strength per square inch.

Mr. Adams: I don't mean to say anything that would be detrimental to scientific investigation, but I must say that I never had much faith in these tests. The New York Central and Pennsylvania make many tests, but have more axles broken than the Boston & Albany, though we never make tests. Our practice and experience lead us to buy our axles of parties whom we believe will do good, reliable work. I suppose the more the iron is worked the purer it is, and we should expect to pay for the working if we wanted a good axle. If a man should offer us axles for 2¼ cents a pound we should refuse them, think them too cheap. Few master mechanics were in favor of the larger axle when the subject was first agitated in 1873; but they finally adopted the Master Car-Builders' standard. The business of the country now demands faster trains and heavier loads, and we must increase the size of the axle for safety. I should prefer to adhere to the Master Car-Builders' standard, if possible. That axle properly made, with 4½ or 4¼ in. dia. in the center, will carry 30 tons; we have carried 35 repeatedly with it. It seems to me that the ordinary merchandise carried between the East and West does not require loads of 80,000 lbs., as some say they carry. Coal or iron may be carried that way, but the average of other freight would not be over 10 tons a car. Then why should we build cars for ordinary business to carry 60,000 lbs.? The average tonnage of freight that comes in on our road is about eight tons to the car. It is economical to carry coal in 25 or 30 ton loads, and we want large axles for that; but I should not put such an axle under an ordinary merchandise car.

The President: We must have an axle strong enough not to break, even if the material is not the finest. We must have a larger axle, and I think Mr. Johann struck the key-note when he fixed upon that plan, with journal of the size shown in this diagram. He does not change a thing, as far as the present standard is concerned, except to make a new axle-box, and that is a small matter. I don't think that a large journal is so liable to heat as a smaller one, and that size 4½ by 8 inches will wear longer with less friction, and seems to me better than anything we have had before.

Mr. Coleman: The larger the journal the less trouble from heating and cutting the boxes. Much of the trouble with car bearings is due to the small diameters and insufficient wearing surface. Some roads will not buy as good axles as the Boston & Albany does, and they should be large to meet the difficulty arising from the use of poor material. The increased traffic on our roads is to be met by a greater number of light cars, run at much higher speed, rather than by increasing the size of the cars and the loads. High speed in freight trains can only be accomplished by making the machinery of the cars as fine in every particular and as accurate and as good in every way as that of the tender of a locomotive. It must be in first-rate order to be run economically. We shall improve our trains by improving our whole method of making the running gear.

Mr. Howard (Engineer of Tests at the Watertown Arsenal): We are engaged at the Watertown Arsenal in testing structures and materials. There are certain stresses to be resisted by a certain amount of material. We have, in the problem of the axle, to find out what those stresses are and the ability of the material to resist them. It is easy to ascertain what the stresses are in a static manner —that is, those which affect the axle when not in motion —but it is somewhat difficult to tell just what the maximum stresses are when it is running. We have been testing some axles for the Boston & Albany road with a view of ascertaining whether there was any structural change which the material underwent. The last one we tested had run in the problem of the axle, to find out what those stresses are and the ability of the material to resist them. It is easy to ascertain what the stresses are in a static manner —that is, those which affect the axle when not in motion —but it is somewhat difficult to tell just what the maximum stresses are when it is running. We have been testing some axles for the Boston & Albany road with a view of ascertaining whether there was any structural change which the material underwent. The last one we tested had run nearly 200,000 miles, and there was not found to be any change in its properties shown by the tensile test. The question of alternating stresses from tension and compression is one which comes into the investigation of axles. We have not tested any axles which did not show a large amount of ductility; they stretched from 15 to 18 per cent. before they showed any tendency to rupture. Any one would judge that a steel axle is better than an iron one. High strength does not necessarily give the best qualities for an axle, though in many cases it would. In the case of steel, a fine crack once started in an axle will extend with rapidity, especially with cold rolled metal. We have met with a good many cases of brittle fractures in steel, and have found that notwithstanding this brittleness, the metal could be bent cold, with the brittle surfaces still in the specimen, which shows that steel of good tough qualities may at times break; and it is my impression that fibrous material is best adapted to resist those sudden breaks, because the want of continuity of material assists those fine cracks which sometimes occur. It would seem then that an axle might be made which would have only one dangerous section, which would be at the junction of the journal with the larger part of the axle, which is the place where these fine cracks commonly commence. These incipient cracks can be detected by inspection, if the inspection is often enough. One or two tests have shown that the elastic limit of axle material is nearly much reduced by a moderate amount of heating, and the elastic limit of an axle made of soft material would run down to a dangerous point. The higher the elastic limit the greater the load the axle will endure without passing the elastic limit either on the tension side or the compression side.

Mr. Coney: Is it not the case that in testing a fagoted axle in different places you get very nearly the same condition, but if you test a scrap axle in different places, you get a variation? That is, an axle made of homogeneous iron ought to be nearly the same throughout.

Mr. Howard: In one instance of a scrap axle which was ruptured near the surface, we found a decided difference between the strength of the metal at one end and that of the other; the fractured end being the weakest.

Mr. Coney: Is it true that it hurts steel to hammer it?

Mr. Howard: The effect of hammering it is to increase its tensile strength; we have met with no instance where hammering diminished its tensile strength. It increases its limit of elasticity, and is accompanied by a loss of ductility. You can judge for yourself whether it would be improved or injured for any purpose by that treatment.

Mr. Brown: Is it a proper thing to do to play the hose upon a hot box to cool it?

Mr. Howard: I thing that would not be a proper thing to do. The stresses upon the material ought to be as uniform as possible. The outside fibers will be the most strained by such treatment, and if you have initial strains on top of the initial strains which come from the load, it would overstrain the material.

Mr. Adams: Suppose we were running a train to Boston, and when 20 miles away we found a hot box, red hot, and we could not stop to cool it, except by putting water on it, and we cool it as quickly as possible, in order to get in. Now, should we run any risk in using that axle again, after this sudden cooling?

Mr. Howard: I think in that case there would be an initial strain caused there, and that it would remain there until the metal was brought to a high temperature again, and slowly cooled, but you would run the risk of warping.

Mr. Adams: An axle treated in that way after being so heated in running, would be safer than if not treated so.

Mr. Howard: I think so.

Mr. Adams: Do I understand that an axle can be run 250,000 miles without any thing being done to correct any initial strain it may have, without any change in its strength whatever?

Mr. Howard: In the case I mentioned we did not notice that the axle was affected. That does not show that every axle could do this. It shows that those particular axles were large enough to do this without injury.

Mr. Adams: We have entertained the idea that an axle deteriorated by long use, and that led to an order on our road that no axle should be allowed to run over 200,000 to 250,000 miles. Now, if your investigations show that there is no deterioration, it would be safe to run longer?

Mr. Howard: There are certain stresses the material is capable of enduring for a definite period, and we are endeavoring to find out the limit of those stresses. A very light load would not ever produce a change, but certain high loads apparently do; and, unfortunately, the stresses come alternately, first one of tension and then one of compression, and that is the most dangerous kind,

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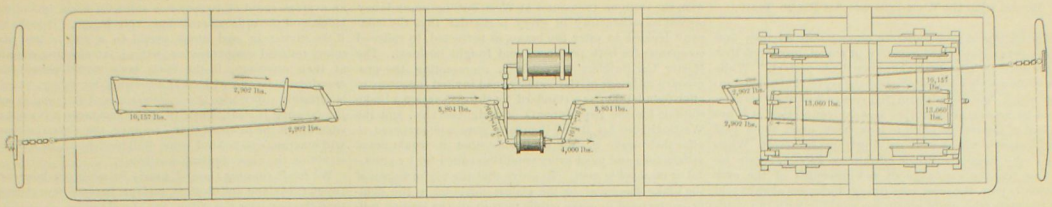
An eighty-ton flat car, the largest ever constructed in this country, is building at the Lehigh Valley shops at Packerton, Pa., for the purpose of hauling a piece of machinery from New York to Bethlehem, Pa. It will be three times as long as the ordinary flat car,



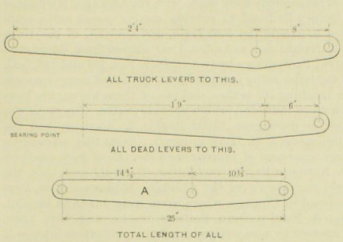
BRAKE POWER AS APPLIED TO PASSENGER CARS ON GRAND TRUNK RAILWAY.

The diagram represents the system of brake power as applied to passenger cars on the Great Western division of the Grand Trunk Railway. This system of leverage has been in use for about 20 months, and is now applied to all the passenger rolling stock on that division, consisting of 220 cars. The result from its use has been to reduce the number of skidded wheels by air brakes to zero. To insure the proper lever being used, the weights of the cars have been classified into 8 classes, and each cylinder lever is stamped with a letter indicating the class; the cylinder plank on car is also lettered, showing class of lever required.

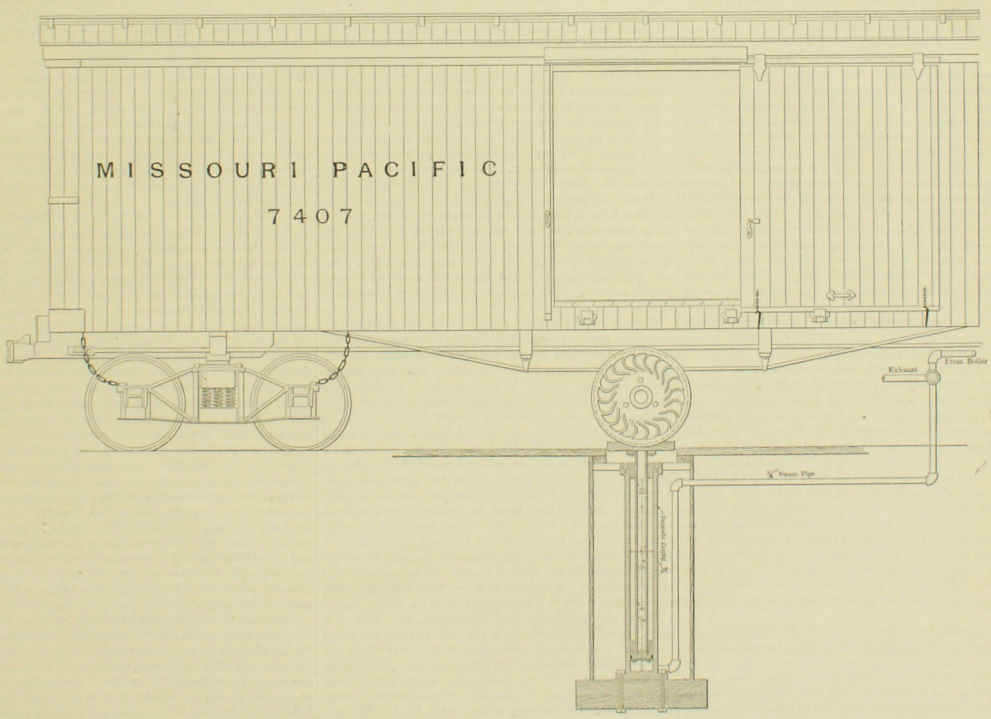
To illustrate, take an 8-wheeled car weighing 50,000 pounds total weight on rails. The weight on each pair of wheels is 12,500 pounds. The weight of car and class (letter B) is stenciled on cylinder plank and stamped on lever. To obtain a brake pressure on wheels 5 per cent. less than weight of same on rails, a cylinder lever with holes 14.22 inches from pistou to fulcrum and 10.78 inches from fulcrum to weight is used.

The Westinghouse standard air pressure of 50 pounds per square inch on piston is used in these calculations. The weight of cars and trucks on table gives the weight of cars on G. W. Division, and the levers assigned to each are not applicable to a car under weight given, but to any intermediate not up to next class.

Attention is directed to an error in the diagram, which was discovered too late for correction. The figures on cylinders levers should be 10½ × 14½ in. instead of 10½ × 16½ in.; and the bearing point on dead lever should be at the dotted line 1 ft. 9 in. from fulcrum hole.



Weight of car and trucks.	Number of wheels under car.	Weight on each pair of wheels having brake power.	Length of cylinder lever. From piston to fulcrum.	Length of cylinder lever. From fulcrum to weight.	Class.
Pounds.		Pounds.	Inches	Inches.	
82,500	12	13,750	14.80	10.20	A
55,000	8	13,750	14.80	10.20	A
75,000	12	12,500	14.22	10.78	B
50,000	8	12,500	14.22	10.78	B
71,250	12	11,875	13.91	11.09	C
47,500	8	11,875	13.91	11.09	C
67,500	12	11,250	13.57	11.43	D
45,000	8	11,250	13.57	11.43	D
63,750	12	10,625	13.21	11.79	E
42,500	8	10,625	13.21	11.79	E
60,000	12	10,000	12.84	12.16	F
40,000	8	10,000	12.84	12.16	F
52,500	12	8,750	12.	13.	G
35,000	8	8,750	12.	13.	G
30,000	8	7,500	11.04	13.96	H



HYDRAULIC CAR WHEEL LIFT.

The engraving shows a very simple form of hydraulic elevator used by the mechanical department of the Missouri Pacific Railway for loading wheels into cars. Those accustomed to the ordinary crude methods followed for loading car wheels will readily appreciate the advantage of the device shown. It is simply a stationary hydraulic jack operated by the water pressure available at the shops and built in the ground in a position convenient to the point where wheels are stored. By this aid to labor an ordinary car can be loaded by two men in half an hour. In these days, when cars are scarce everywhere, the saving of time alone in getting cars loaded with wheels ought quickly to pay the whole expense of getting out lifts of this kind.

Mr. F. W. Johnstone, superintendent of motive power of the Mexican Central Railway, is spending a month in New England with his wife for the benefit of her health. In a conversation with Mr. Johnstone we learned that his company are doing a heavy and constantly increasing business. They are also making considerable extension of track. To meet the calls of the increasing traffic, they are getting ten new locomotives built at the Baldwin Locomotive Works. In the NATIONAL CAR AND LOCOMOTIVE BUILDER of December, 1886, we illustrated a new style of four-cylinder locomotives designed by Mr. Johnstone. He has recently worked out a method for compounding this engine, and expects to get one of them built soon. His company have to pay about seven dollars a ton for coal, so that a small saving of fuel would well serve to pay for the additional cost of maintaining a compound engine.

Round with the Westinghouse Air Brake Train.

The sentiment now sounding among railroad men and every person interested in safety of travel, proclaims that "the automatic air brake has been made perfect." While we contemplate with satisfaction the perfection in machinery which has to perform the vitally important services done by brakes as desirable beyond conception, it is not devoid of interest or profit to look back upon some past performances which were not illustrious successes. When men who handle railroad machinery do congregate together for the exchange of reminiscences of the ever romantic past, the most interesting stories are always told by the men who could remember working with the crudest kind of tools. With perfected machinery to do the work there is little margin left for the man to display the heroic.

When the brake trials took place at Burlington last May under the supervision of the Master Car-Builders' Association, the Westinghouse Air Brake Company put in competition a train of 50 cars equipped with an improved form of brake which applied the shoes to the wheels of the last car in the 50-car train in about 5 seconds. This was a decided advance on the old automatic air brake, which took about 17 seconds to operate the brake levers of the last car in a train of the same length. It was supposed that this rapidity of action would be quick enough for all practical purposes, but after the tests began it was found when the brake was suddenly applied with full force, as in an emergency stop, that the front portion of the train ceased moving before the brake was applied to the hind car, the consequence being that the latter bumped up as against a solid rock, and the stop was like that made by an old woman who went down with a broken elevator and complained that the stop was too sudden. It is hardly necessary now to tell how certain observers of the trials went riding in the hind car of the train, and how they were not ready to stop as quickly as the car, but went flying like missiles from a catapult, making the end of the car a target. The story is well known, and some men who were not near the scene of the tests relate with striking exaggeration stories of their exciting experience, and dilate on how nearly they were pitched through the end of the car.

Although now regarded as little more than a ludicrous incident worthy only of telling funny stories about, the hard bumps exerted an important influence on the development of the brake. The violence of shocks that accompanied sudden stopping enabled interested parties to raise the shout that electricity was necessary for the operating of brakes in stopping or controlling very long trains. Till then Mr. George Westinghouse, Jr., had left the work of improving the brake to meet the conditions of train service almost entirely to his assistants, but when the agitation in favor of using electricity as an adjunct to air brakes arose he turned his personal attention earnestly to find what could be done by air alone. The experience which the Westinghouse Air Brake Company had had with electricity for signaling and other purposes, made the officers strongly opposed to using it in connection with brakes, and, taking the velocity of gases under pressure as a basis to work from, Mr. Westinghouse felt assured from the first that he could quicken the time of application sufficiently to eliminate all shocks in any length of train it would ever be practicable to run regularly.

He set vigorously to work, and after numerous experiments produced improvements which reduced the time of application to the farthest brake from the engine in a train of 50 freight cars to a fraction less than two seconds. As the velocity of compressed air at 60 pounds above the atmosphere is about 1,800 feet per second, and as the brake is applied 1,900 feet from the engine in less than two seconds, the air passes through the train at nearly its maximum speed. The application of the brake shoes to the wheels of all the cars was now practically simultaneous, and there remained no means of one car bumping against the other, for the power applied tended to keep each car a separate unit in the act of stopping. An incidental advantage to braking a train in this way will be the saving of the car draft rigging from the damage done by jerks or concussions common to all slow methods of applying brakes.

The improvements effected were on the triple valve and the engineer's valve and the train pipe is enlarged to an inch and quarter size. The improved brake not only applies with a velocity that resembles electric more than pneumatic action, but it releases much more promptly than the old brake, a characteristic which will be highly appreciated in operating trains that have to stop frequently. The graduations between full application and release are also much more perfect than with the old brake. As the changes effected on the mechanism can not be made clear without the aid of engravings, and as the company are not yet ready to permit the publication of the new triple valve, I shall defer attempting a description till it can be accompanied by the necessary cuts.

When it was found by repeated trials in the works at Pittsburgh that the improved mechanism could be relied upon to apply all the brakes in a fifty-car train in less than two seconds, a full equipment of the improved brake was prepared and applied to the train of fifty cars which had been used in the previous tests. Trials were then made with the train on the course at West Burlington, and they proved so satisfactory in every particular that the company decided to offer the brake, as perfected, to railroad companies for both passenger and freight business. The Master Car-Builders' Association, representing the progressive railroads of the country, had invited inventors to offer for adoption as a standard by the association a brake suitable for the requirements of freight service, and the Westinghouse Air Brake Company were now prepared to offer their brake in full confidence that it would prove satisfactory and meet every condition called for by practical or reasonable men. To prove that the performance of the brake was equal to the claims made for it, the company arranged to make public tests in all the leading railroad centers. Many prominent railroad officers had expressed a wish to see for themselves the kind of stops made, and to watch the effect on the cars of the very sudden application of powerful brakes, and the only way to gratify this desire was to take the train to the leading cities.

Arrangements were made with the Chicago, Burlington & Quincy Railroad to provide motive power and a train crew to handle the long train, and on Oct. 13 the train of 50 freight cars and a hotel car started from Burlington for St. Paul, drawn by two engines, Nos. 119 and 145, both of the latter being equipped with the latest improvements for handling the brakes, and one of them having the Boyden speed indicator, which proved reliable. The route was over the Burlington, Cedar Rapids & Northern and the Minneapolis & St. Louis railways. Tests that attracted a large concourse of railroad men and others were made on the Northern Pacific tracks near St. Paul, and then the train was taken over the Chicago, Milwaukee & St. Paul Railroad to Chicago, where tests were made on the Chicago & Northwestern Railway tracks, and were again witnessed by many railroad officers, and others interested in railroad operating.

The runs from Burlington to St. Paul, and from St. Paul to Chicago, took the train over an extended mileage, where the track conforms closely to the profile of the country. Cutting and filling has been engaged in as sparely as possible, and the long train would occasionally cover two waves of land and reach over the intervening sags. Then there were steep grades, sharp curves and the worst forms of undulating tangents to be traversed, but the train went smoothly onward, the incidents of travel all too meager for an ambitious writer. At first, when one watched the long train winding itself in several twists round reverse curves, or corrugating over successive humps, there was a vague impression that something must happen to break the monotony of the journey, but the train followed the engines intact, and the brakemen and conductors reposed in their cars without any thought of being called to set brakes. On one occasion there was a slight ripple of excitement. The trackmen had a rail out, and with the habit so common to men of that ilk, took their chances and were unprotected by a flag. The train rounded a curve four or five hundred feet away, and the gang boss seized a flag and ran waving it wildly, but expecting to see the train rush into the opening and thence through a bridge which was a few feet away. But the train stopped, and the trackmen stood with open mouth amazed. With any other train there would have been a wreck.

Western roads put little restriction on the speed run by the train, and this enabled us to fairly estimate how fast freight trains could be run comfortably without forcing, if the train is equipped with the brakes that give the engineer absolute control of the speed. With this train there was no necessity to approach stations at one-tenth the running speed, as ordinary freight trains must do, so the benefit was had of maintained speed. In the round from Burlington to St. Paul and thence to Chicago, a distance of 800 miles, an average speed of 20 miles an hour was made over divisions. This does not appear to be a high train speed, yet it is much higher than the distance ordinarily traveled per hour by freight trains, and was very fair for single track roads where there is always some delay in meeting trains. When the men in charge of a train of this kind have permission to go right ahead the engines appear in the light of topers who make short time between drinks. It appears as if the train is hardly going comfortably when it is necessary to stop for water.

When the cavalcade first started out, the train was made up with the hotel car in the rear, but this was found to be an inconvenient arrangement in many ways, and it was finally settled to keep it in front. There were always visitors on the car besides the regular party, and a vast fund of railroad mechanical philosophy was enunciated during the various journeys. Mr. H. H. Westinghouse was in charge of the train, and he made the whole of the round trip, as did also Mr. L. W. Close, engineer of the company, and Mr. Charles T. Brown, stenographer. The writer occupied a place in the hotel car in all its windings from St. Louis by Cincinnati, Cleveland, Buffalo, Albany, Boston, New York, Philadelphia to Washington. There was a train crew consisting of Mr. G. Anderson, engineer of No. 119; Mr. G McDowell, engineer of No. 145, and Mr. Joseph Maguire, conductor, besides two firemen and four brakemen, as good a crew as ever hurried a train over the road.

One of the best runs made in the whole journey was from Chicago to St. Louis over the Chicago & Alton Railroad, the whole distance of 280 miles having been run at an average speed of twenty-five miles an hour, including stops, and the railroad crossings were legion. It looks as if the saving in coal alone would in a year or two pay many railroad companies for putting interlocking signals at their crossings, if the State laws would permit the crossings to be run with that provision for safety, which is certainly superior to the crude practice of stopping to see if a crossing is clear, when in many instances it is impossible to tell the moment that a train on the bisecting road will emerge from behind some building, wood, or hill obstructing the view, causing a collision.

We made running time of nearly 30 miles an hour between Cleveland and Buffalo, but the distance was shorter than the trip over the Alton, and the obstacles to getting along were fewer.

There is talk of running fast stock trains from Chicago to New York by the Lake Shore and the New York Central roads. From what I have seen on this trip, I conclude that good engines could take a train of twenty cars along and make an average running speed of twenty-five miles an hour throughout the whole journey, making the run in about 42 hours. This could be done safely with a well-braked train, and the engine would have a paying load all the time. If higher speed were desired, the conditions for weight of the freight train would have to equal to that of the ordinary passenger train.

While going over the Chicago & Alton Railroad an incident happened which strikingly illustrated the power of the brake. While running down a descending grade of 60 feet to the mile at a speed of 51 miles an hour, the train was flagged for a train in front. The stop was made in about one thousand feet—the length of a passenger train of thirteen coaches.

It was often curious to note the view different railroad men took of the brake. Many were zealous in urging that it ought to be applied to all freight cars immediately; and others were enthusiastic about the accidents it was going to prevent and the aid it would be in getting trains quickly over the road. But some men were very non-committal about it. They were very well satisfied with the old brake and thought it good enough for their needs. They did not believe in changes, and were afraid that their men would not fall quickly into the way of working and taking care of the new brake. As the journey proceeded it appeared that the doubters were blotted out, and the enthusiasts had entire control of the meeting.

When I have been writing about brake failures, I have taken pains occasionally to mention that trouble with the air brake resulted to a great extent from the men handling it being ignorant of the mechanism. Where the brakes are well looked after, and the men required to understand all about them, failures are almost unknown; where the men receive no encouragement to acquire a knowledge of the brakes' mechanism and where the apparatus is left to take care of itself till something fails to work, trouble with the brake is chronic. During this trip I have concluded that engineers have on many roads good excuse for not knowing more about the brake than how to start the pump or how to manipulate the engineer's valve. So much has been said and written about the automatic principle of the brake, that it might be supposed that every railroad man above the position of a section hand would know what the automatic functions of the brake were, yet in conversations with several general officers, I found they did not know that the brake would apply itself on both sections of a train that accidentally broke in two. Where the officers do not trouble themselves to understand the brake and its needs, the trainmen can scarcely be expected to pay much attention to it. On some roads there is a great tendency to run trains with straight air on the most trifling excuse, and I am now persuaded that on such roads, the officers do not understand the automatic functions. Curiously enough in the East where one expected to find advanced knowledge about mechanical matters and general understanding of the brake mechanism, the ignorance was greatest. In the East there is too great a tendency to place experience above industry and intelligence. A man who has been twenty years at the throttle and merely knows how to stop and start the train, is reckoned superior to a studious man who knows the purpose of every connection of his engine but has only been running for five years.

Occasionally we met railroad officers who were so practical that they could not see any thing in the tests made, but they would be forced into expressions of admiration for the way the train was handled going down steep grades or in stopping at stations. Frequently requests were made to stop on certain parts of the road traversed to show quickly and how smoothly it could be done. Mr. C. C. F. Bent, superintendent of the Ohio & Mississippi Railroad, accompanied the train part of the journey over his road from St. Louis to Cincinnati, and two rather notable stops were made for his satisfaction. There is a grade on the road twelve miles long, averaging over 60 feet to the mile. Mr. Bent made up his mind that this grade was the place to test the value of the brake, so he sent his train master to ride on the engine and to see that they got going lively, while he took his place in his special car on the rear of the train. There were numerous curves on the grade and after five miles of a run with the engines using steam all the time, the speed attained was only 54 miles an hour. The train master was anxious for a pace of a mile a minute, but he eventually gave the signal to stop

when the speed indicator on the engine pointed to 54 miles an hour, and the train came to rest with the 26th car opposite the point where the air was applied, the distance run having been about 1,000 feet. The superintendent was satisfied that the speed attained was high enough and was thinking of using the conductor's valve to stop when the brakes were applied. It was a very convincing object lesson. Another stop was made on the same grade to show what would happen if an engineer was flagged near a certain station that had been the scene of frequent collisions. With this train no accident would have happened.

An exceedingly pleasant run was made over the Ohio & Mississippi, and the country traversed was interesting and picturesque. The road is in excellent order, is well operated and has been very greatly improved in every way under the able management of Mr. J. F. Bernard.

The run from Cincinnati to Cleveland was made over the Cleveland, Columbus, Cincinnati & Indianapolis. The management of this road object to double heading, and we had to go over in two sections. While hating to have the train divided up, all concerned acknowledged the wisdom of the fiat which gave each locomotive a train.

From Cleveland to Buffalo by the Lake Shore road and from Buffalo to Albany by the New York Central, no restrictions were put on about speed, and very good runs were made. The trip from Albany to Boston was made over the Boston & Albany, and here we began to feel the conservative tendencies of New England management. They divided our train into two sections, and issued orders that the speed should not exceed twenty miles an hour. They held us five hours at Springfield, and then made us run fifteen miles an hour from there to Boston. The Boston & Albany Railroad is the best equipped road in New England with the appliances for operating a railroad safely. There is an excellent double track, and every switch is protected with a distant signal, and the signal system appears to be well worked. These conveniences ought to facilitate the movement of trains; but if the way they hurried our train over the road is the way they ordinarily move their freight, it is no wonder that cars are scarce. It took us about 20 hours to get over 150 miles.

Shore Railroad, the scene was particularly impressive. It was the last of the series, and happened in the dusk, when it was necessary to light the head-lights of the locomotives. Both trains came rushing down a steep grade, the head-lights glaring side by side like the eyes of some great monster. They passed the spectators at a speed of forty-five miles an hour, and the brakes were simultaneously applied. The freight train, with the new brake, was stopped in 4 5 feet, and the passenger train, with the old brake, ran 1,204 feet before the stop was made. That stop of the passenger train would seem to indicate that the leverage of the brakes was very low, and illustrates the practice so common of keeping the leverage too low in the anxiety to prevent the sliding of wheels.

As has already been mentioned, the incidents of the long journey of about 3 500 miles were remarably few, and illustrated how safely a well equipped train can be run, even when it is unweildy to handle. The close Janney coupler with which the train was equipped doubtless greatly contributed to the prevention of delays from the breaking in two of that extremely long train. There were two breakages and consequently two involuntary stops in the course of the journey. While we were ascending a grade on the Ohio & Mississippi Railroad, the draft timbers on one car dropped down, through the bolts having been broken, and permitted the coupler head to drop till it slipped away from the other head. The train parted and of course stopped instantly, with an opening between the cars of about twenty feet. On another occasion, when we were going from New York to Philadelphia over the Pennsylvania road, the end of the pin which holds the hook of the coupler shut was sheared off on one draw-bar, letting the hook open. The train was running about forty-two miles an hour at the time, and the automatic stop was made in about 600 feet, which included a full car length of opening in the break.

The work of preparing for the tests was carried out very systematically by the officers of the Westinghouse Air Brake Company, and no time was lost except by unavoidable delays. Mr. W. W. Card, secretary, and Mr. Henry Snyder, special agent, went away as soon as the tests were over at one place and arranged for what was to be done to hill. supt. M. P.; H. B. Chesley, supt.; E. L. Sackett, Supt.; H. W. Eddy, M. M.; T. B. Purvis, M. M., and J. E. Doran, M. C. B., of the Boston & Albany; Messrs. J. F. Adams and H. A. Phillips, supts. Fitchburg R. R.; Messrs. C. W. Bradley, gen. supt.; J. P. Bradfield, supt., and Thomas Aldcorn, M. M., of the West Shore road.

The method of running the train and of making the various tests has been described in last issue of the NATIONAL CAR AND LOCOMOTIVE BUILDER. A few minor changes were made to suit the conveniences of different localities, but the plan followed was substantially the same throughout. The tests which appealed to railroad men most forcibly were the breakaway tests showing how promptly a parted train could be stopped, and the parts kept from telescoping each other; and the stops made with the greatest possible leverage that could be used. The stops were so sudden in the latter test that the thing appeared incredible. In one instance the train running at 19 miles an hour, was stopped in 78 feet—two car lengths. Some of the most disastrous accidents on record have happened to trains running at about this speed, yet, here was the means of stopping within three rail lengths.

Stopping the whole train of fifty cars at forty miles an hour, with leverage that no wheels would be slid, was generally done in a distance equivalent on the level to about 580 feet, and the feat elicited much admiration. It was fairly calculated to excite wonder. A train weighing 2,000 tons rushing along at 58.4 feet per second, an aggregate of 116,800 foot-tons of mechanical energy to be changed from motion to heat in twenty seconds in a distance of 580 feet.

A. S.

PRINCIPAL STOPS MADE IN THE VARIOUS BRAKE TESTS.

	St. Paul.			Chicago.			St. Louis.			Cincinnati.			Cleveland.			Buffalo.			Albany.			Boston.			New York.		
	Speed, miles per hour.	Distance in feet.	Time in seconds.	Speed, miles per hour.	Distance in feet.	Time in seconds.	Speed, miles per hour.	Distance in feet.	Time in seconds.	Speed, miles per hour.	Distance in feet.	Time in seconds.	Speed, miles per hour.	Distance in feet.	Time in seconds.	Speed, miles per hour.	Distance in feet.	Time in seconds.	Speed, miles per hour.	Distance in feet.	Time in seconds.	Speed, miles per hour.	Distance in feet.	Time in seconds.	Speed, miles per hour.	Distance in feet.	Time in seconds.
Emergency stop, 50 cars	19	172	7	22	184	10	20	176	10⅝	25	284½	12½	26	265	12	21	214	12	20	158	10	19	123	10½	23	203	12¼
" " "	36	490	14¾	37	488½	15	36	507	18	35	542½	17½	43	719	20¼	40	479	19	33	560	18¼	32½	406	15⅝	41	674½	20
" " "	37	583	....	34	470	15½	35	502	17	37	573	17⅝	38	636	19½	39	648½	19½	37	580	19	34	483	17	41	672½	20
Hand brakes; five brakemen at their posts	....	....	....	20	1,200	62	21⅛	2,115	128	20	2,000	79	20	1,711	65	20	1,000	48	20½	1,342	60½	21	1,035	53	21	2,153	....
Emergency stop; 20 cars, increased leverage	20	109	...	20	124	....	20	109	5½	20	102	6⅜	20	96	6⅜	20	93	6⅜	19	78	5	20	111½	7¾	22	91	6
Emergency stop; 20 cars, increased leverage	37	327	....	33	272	....	38	377	11	41	425½	12	40½	375	12⅛	39½	414	13¼	40½	358	12¼	....	....	....	....	....	....
Race stop; 20 freight cars, with new brake	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	38	319	15	45	495	13½
Race stop; 12 passenger cars, with old brake	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	38	574½	17	45	1,204	19½

The track where the tests were made was nearly level at St. Paul, at Chicago, and at Boston; but at the other places the work was done on descending grades. At St. Louis, it was 53 feet to the mile; at Cincinnati, the descent was 50 feet to the mile; at Cleveland, 40 feet; at Buffalo, 32 feet; at Albany, 35 feet; at New York, 53 feet to the mile; and at Philadelphia, 40 feet to the mile.

From the time the train left Burlington till it got to the Atlantic seaboard, the interest among railroad men in the experiments appeared to keep increasing. By the time we reached Boston the excitement was at fever heat and was the leading topic of conversation wherever railroad men were to be heard talking. Nor was the interest in the brake confined to railroad men. College professors, scientific students, engineers of every kind, literary men, newspaper men and all classes representing the knowledge, the culture, the refinement, the progress and the humanity which are the pride and boast of New England, were ready and willing to interest themselves in an invention which was likely to reduce the peril of travel and end the slaughter of trainmen. The various classes gave practical proof of their interest in the invention by attending the public tests, and the most representative and influential gathering of spectators to witness the tests came together at Boston. The Railroad Commissioners of Massachusetts, and representatives from nearly all the railroads in New England and Canada, were present. A new feature was introduced into the tests at Boston which proved very interesting. A trial was made to resemble a race between two trains, the contest turning on which one could be stopped first. A train of twelve passenger cars equipped with the old automatic air brake, and a train consisting of twenty freight cars with the perfected brake, were run side by side on parallel tracks up to the stopping post, at a speed of forty miles an hour. The spectacle was very striking and excelled any horse race ever run. The engines were admirably handled, and reached the stopping post pilot to pilot. When the brakes were applied, the freight train stopped in twelve seconds on 319 feet; the passenger train kept moving for five seconds longer and covered 548 feet in stopping.

This test was repeated at other places with some variations. In the tests made near New York, on the West

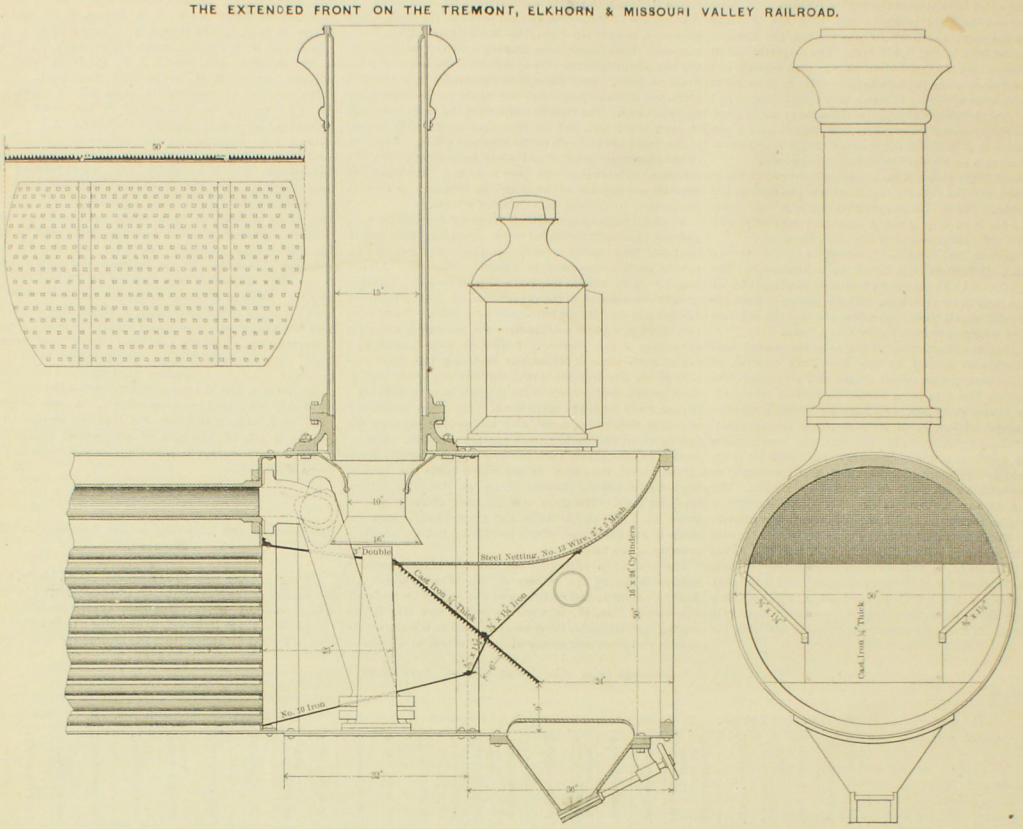
Want of space prevents me from enumerating even the leading railroad men to witness the tests. Among those who traveled on the train were: Mr. Joel West, master mechanic of the C., B. & Q., who accompanied the train from Burlington to Chicago; Messrs. T. W. Welsh, L. W. Close and Frank Moore, of the Westinghouse Company; Mr. Robert Safely, division master mechanic; Mr. Wm. Voss, M. C. B., and Mr. Gage. trainmaster, B. C. R. & N. Railway; Messrs. Holmes, superintendent; Johnson, trainmaster, and George Wilson, M. M., of the M. & St. L. Railway; Messrs. J. T. Clark, gen. supt.; A. J. Earling, asst. gen. supt.; H. G. Collins, supt.; E. W. McKenna, supt.; J. N. Lowrey, gen. M. M.; J. N. Barr, supt. car dept.; George Gibbs, mechanical engineer; J. E. Pattee, M. M.; E. A. Wescott, M. C. B., and J. Kershaw, air brake inspector, C., M. & St. P. Railroad; Messrs. Wm. Wilson, supt. machinery; J. Townsend, M. C. B.; Richards, supt., and Hawkes, air brake inspector, C. & Alton Railroad; Messrs. Willard Smith, Crossman, Tyler, Lewis and Barnes, of the *Railway Review*; Mr. McArthur, of the *Railway Register*; Messrs. Boardman, Prout, Fraser, Adams and Bailey, of the *Railroad Gazette*; Mr. Henry Guy Carleton, *New York World*; Messrs. C. C. F. Bent, Supt. F. P. Boatman, M. of rolling stock, Coulter, M. C. B., O. & M. R. R.; Henry Tragellis and Mr. Sague, of the Erie road; Messrs. A. B. Under-

Car Heating and Lighting on the Connecticut River Railroad.

During a brief visit to Springfield, Mass., lately, a representative of the NATIONAL CAR AND LOCOMOTIVE BUILDER was invited by Mr. J. Mulligan, superintendent of the Connecticut River Railroad, to examine a train on his road that is heated by steam from the locomotive and lighted by electricity generated by a small engine in a corner of the baggage car. To us the train seemed an ideal train so far as heating and lighting are concerned. The heating is effected after the Emerson system and the cars are kept very comfortable, no difficulty being experienced in regulating the temperature to suit any kind of weather. A Mason regulator is used to keep the steam pressure even, and the men in charge speak very highly of its efficiency. The system of heating cars by steam materially increases the duties of the trainmen, and puts duties upon them which require care, intelligence and vigilance. Where these are wanting there is great likelihood of the cars being kept so changeable in temperature that the passengers could not endure it.

The cars are lighted by 16 incandescent lights inside and one at each end outside under the roof. They are the best lighted cars we have ever seen, and are said to be highly popular with passengers. The system of lighting used was devised for railroad passenger trains by Mr. S. H. Barrett, of Springfield. The engine used is a small six-piston disk machine, a modification of the West engine, well known in Great Britain. The engine develops about seven horse-power and gets steam from the locomotive through a 2-inch pipe. The drain from the locomotive is said not to be perceptible in affecting the engine's steaming. A Julien storage battery of twenty-four cells is used in connection with the system. The dynamo supplies the electricity direct to the lights or into the storage battery as the operator desires, the moving of a switch affecting the change, and the surplus electric energy not needed for lighting goes to the storage battery. When the locomotive is not attached to the train the lights are kept going from the storage cells. The storage battery accumulates electric energy sufficient to light a train of three cars for six hours. Means are provided for graduating the intensity of the light, as can be done with a gas jet.

THE EXTENDED FRONT ON THE TREMONT, ELKHORN & MISSOURI VALLEY RAILROAD.



The engraving is from a blue print sent us by Mr. S. A. Teal, the master mechanic of the road, and we are also indebted to him for the following description :

"There has been a great deal said and done about the extended front end and straight stack. It has its friends as well as enemies. We belong to the former. We believe in the extended front end as we have it, and inclose herewith a blue print of our style, showing especially the deflecting or baffle-plate, which you will notice has cast on its face or back side a great many sharp projections, or what we call stickers, about 1 inch apart and 1½ inches long and ⅜ of an inch square at base, tapering to a sharp point. The baffle-plate is made of cast iron. These stickers are put on irregularly, or, in other words, not in line, or zigzag, if you please, so as to break joints, the object of which is that the cinder or particles of coal passing through the flues come in contact with these teeth or stickers, and are so pulverized or ground up as to be no heavier than the gases, and pass out of the stack dead, and, of course, perfectly harmless. You will also notice a lower baffle plate running from front flue sheet forward to within about 6 inches of upper or sticker baffle-plate, its front edge being about 4 inches above lower edge of upper or sticker baffle-plate. The object of this plate is to convey all cinders or particles of coal that may pass through lower flues up and against and in contact with stickers or upper baffle-plate. The result of this is, as you will see, that nothing can pass through netting or out of stack until it has passed through these stickers or teeth, hence no fire is thrown from stack, and nothing is gathered in front end. We have had this devise in use successfully on a number of our engines for the last eight months, and shall put it on all of them as fast as we can get to them. They are good steamers, but care must be had in firing, as they will not stand very heavy fire with our Iowa soft coal, which is the only fuel we have. You will also notice that our netting runs from front end back to front side of nozzles, where it unites with a plate of, say No. 12 iron, which is continued back and fastened to flue sheet as shown. Care must be taken to have this plate or sheet fitted nicely to sides of smoke-arch, and also fitted nicely to steam pipes and around nozzles. As the success as a spark arrester depends largely on having this plate fitted absolutely tight, so that no spark can pass out of stack unless it passes through the netting, the intention is to have every thing that goes through the flues come in contact with the teeth of baffle-plate, and then through the meshes of netting. In passing through the teeth, the cinder or coal particles get ground up fine, which is the object of this device. The burning of the fire can be changed by raising or lowering the petticoat pipe. Besides the changing of burning of fire, this petticoat has other advantages, one of which is, that it keeps the plate around nozzles perfectly clean, so that no cinders can be drawn in cylinders, and another is, it concentrates the steam and gases to center of stack. Our engineers have a large hopper, as you will see by blue print. Hence baffle-plate must extend down nearer to bottom of smoke arch because of the large opening in hopper. We have found 9 inches to be about right with this hopper as shown, but with a hopper with small opening, 12 inches would probably be better. The distance can not be the same in all engines.

With this device we get a good steamer, a perfect spark arrester and a very economical coal consumer. It burns less coal than with any other device we know of."

Old Colony Rolling Stock Matters.

During a brief visit to the Old Colony Railroad repair shops, at Boston, I found that they are working an unusually large force of men on the repair work that comes from a very busy season of passenger and freight transportation. There are several engines in the shops getting new boilers. The engines were originally over cylindered, and Mr. Lauder is rectifying the defect by giving them boilers that will be large enough to supply all the steam called for, and heavy enough to prevent much slipping. After considerable experience with special appliances to keep over-cylindered engines from slipping, he has come to the conclusion that the most effectual traction increaser is a good heavy boiler, and he is regulating his designing accordingly. His common practice is to put in a longer fire-box (72 inches) into old boilers, lengthening the shell and spreading the wheels to his standard distance of 102 inches between centers. All the new boilers are of Otis steel throughout, with double-riveted lap and welted longitudinal seams. They have all got wagon-top fire-boxes and there has not been the least indication of weakness shown, although they carry 175 pounds working pressure. A brass ring is used round the fire-box door opening, and it is said to have the merit of never leaking. All the mud rings are double riveted, and continued service with the boilers first put up in this way seems to prove the advantage of having a strong foundation seam. They have here adopted the sensible practice of drilling the outside of all stay-bolts with a hole ⅛ inch diameter. They have recently put several new tools into the machine shop, among which I noticed a particularly heavy wheel-boring machine.

In the car shops repair work predominates, but they are building some new baggage cars and freight cars. There is also a new design of a 25-ton hopper gondola coal car about ready to be put into service. The coal work has hitherto been done in small four-wheel dump cars, and the intention is to change to larger cars, and the gondola has been designed for the purpose. After it has been in service long enough to demonstrate its merits or weaknesses, a decision will be made as to whether or not it is suitable for the business. This car has the standard iron truck with elliptic springs used for several years by the Old Colony. Most roads using iron trucks find that the rivets are very much given to working loose and materially increasing the cost of repairs. On being questioned as to his experience with this weak point of the iron truck, Mr. Lauder assured me that the rivets of their truck gave no trouble whatever by getting loose, and he attributed this to the fact that they took good care to see that the rivets were well upset, properly filling the holes. I noticed that the lid opening of the oil-boxes for all cars is planed to ensure a perfect joint with the lid. They put eight boxes on a planer, and the work, which makes a decided improvement on the box, costs only five cents. The road still owns a great many old passenger cars that were built with cross timbers. They are rebuilding all those that are worth the outlay as quickly as possible, putting in new floors, new inside finish and new modern roof. All the passenger cars are carried on steel tired wheels, and for braking this wheel they are introducing the Ross shoe, which Mr. Lauder considers of great value as a means of increasing the mileage of steel tires between the periods of turning. The company are trying continuous steam heating for cars, and as a means of satisfying themselves respecting the merits of various systems, have equipped one of their trains with the Safety Car Heating & Lighting Co.'s system, and another with the Sewall system. The experience they have with the two systems during the next two months will lead to a decision as to which method of heating cars from the locomotive is to be preferred.

A. S.

In the Otis Steel Works.

In the eastern suburbs of Cleveland, O., on a raised plateau close to Lake Erie, the Otis Iron and Steel Co. have very commodious works, where the largest output of plate steel produced in America is manufactured. To the average railroad man the term Otis steel conveys the idea of plate steel alone, but that comes from the fact that the excellence of the plate steel overshadows the other product, not that the other steel made by the company does not constitute an important industry in itself, for it does so, although comparatively few railroad men know it. Plate steel is principally made by the open-hearth process, because by this method of manufacture the product can be better controlled for the securing of pure steel than by the more rapid process of manufacture in the Bessemer converter.

During a recent visit to Cleveland, I spent a very profitable afternoon with Mr. S. T. Wellman, superintendent of the works, examining the various processes which the products of the mine pass through on their way to form good steel. Till this visit brought me new light, I had shared a prevailing belief that in the open hearth process of steel making the objectionable elements in the ores, the impurities which vitiate the quality of steel, were eliminated. From Mr. Wellman and the observations of the process I learned that the acts of purifying had to be gone through before the iron reached the steel making furnaces. The kind of product must be regulated by the quality of the iron put into the furnace. If the iron is good and free from impurities, the steel will be of fine quality; if the iron contains phosphorus or sulphur in a high percentage, no amount of manipulation will make it a ductile steel.

The regenerative furnace, in which open-hearth steel is made is a huge oven of fire-brick, where the intensely hot products of gaseous fuel are made to breathe incessantly on a charge of selected iron, containing the elements of steel, till the mass is made to boil like water in a kettle. The skill of the man in charge determines the period of boiling necessary to produce a good heat.

The steel made in these works which calls for the greatest exercise of skill and care is the sheets for fire-boxes. The charge of material used in making this kind of steel is regarded as a typical charge. First, there is placed on the hearth of the furnace 13,000 pounds of very fine pig-iron containing under .03 per cent. of phosphorus. This is done at 1. P. M. The heat is then turned on. A current of gas and also of atmospheric air regulated to effect perfect combustion without waste, join before the furnace is reached and are heated to a high temperature by the waste gases. The heat of the furnace is terrific, and rises to about 6,000 degrees Fah. The products of combustion as they pass from the furnace are still intensely hot, but they are passed through honey-comb-like arrangements of fire-brick which absorb the heat. This is done so thoroughly that a man can hold his hand on an iron casing over the passage where the waste gases finally pass into the chimney. When the structure of celled fire-brick begins to get "saturated" with heat, the flow of the gases is reversed, and the cold gases are made to pass through the heated brick on their way to the furnace. This reversing of the flow of the gases is maintained at regular intervals, and by this means all the heat of the fuel is utilized, and the gases raised to a very high temperature before they reach the furnace where the work is done.

Shortly after the heat has been turned on the furnace, through the good offices of Mr. Wellman, I am provided with colored spectacles, which enable me to look into the furnace. The hottest locomotive fire-box is dull to look at compared with the glare of the steel-making furnace, as dull as a common gas jet looks beside an arc light. A little watching makes my eyes accustomed to the glowing light, and I discover that the charge of pig-iron is not yet melted. The individual pieces can yet be distinguished, but they shine like fragments of incandescent ice, and molten drops are falling from their edges, showing that melting has begun. At 2:30 P. M., an hour and a half after the first charge was put in, an additional charge of 9,000 pounds of puddled blooms is thrown into the furnace. This iron contains no more than .015 per cent of phosphorus. The flame from the gas fuel is now permitted to dash upon the mixed charges of iron for one hour and forty-five minutes longer, when again the furnace door is opened and 1,000 pounds more of the same quality of puddled blooms is placed over the previous charges. There is also added 2,600 pounds of charcoal blooms, which contain no more than .02 per cent. of phosphorus. The heat in the previous charges aid in quickly melting the new addition to the contents of the furnace, and in another half hour the mass is ready for another dose, and, accordingly, 3,000 pounds more charcoal blooms are applied. That operation is followed twenty-five minutes later by another charge of 3,000 pounds more charcoal blooms of the previous quality. Again two charges are applied at intervals of twenty-five minutes, the first containing 1,000, the other 750 pounds of charcoal blooms. The mixture is now permitted to stand for one hour and five minutes longer, when it receives the final charge in the shape of 182 pounds of ferro-manganese, a material which contains 80 per cent. of manganese, and is put in for the purpose of carrying off the oxygen that has mixed with the metal. Ten minutes after the ferro-manganese is put in the charge is ready for tapping.

Just before the charge is tapped off I look into the furnace again, and see a great change in the molten caldron. Earlier in the process the reducing of the iron from the solid to the liquid condition was accompanied by violent and tumultuous ebullition. Now the surface of the metal is quiescent, broken occasionally by a spasmodic puff as a bubble of gas rises upward.

The next operation is that of tapping. We have seen 36,732 pounds of metal put into the furnace, but the entire charge produces only about sixteen tons of steel, the balance going off in the shape of gas and slag. The steel is run into ingot molds that are filled from the bottom, a method which increases the solidity of the ingot. The size of the ingot is regulated according to the kind of sheet to be rolled from it. After the steel is poured into the ingot mold, where it changes from the liquid to the solid condition, the next operation is rolling into the sheet. The metal must be long enough in the ingot to become solid before being rolled, but it must be retained sufficiently plastic for working. In some places where fuel is expensive "soaking pits" are used, into which the half molten ingots are put to stand till they are ready for rolling. In the Otis works, the ingots are permitted to stand exposed to the air long enough after they are cast to permit complete solidification. They are then lifted on to cars running on a narrow gauge track and conveyed to the reheating furnace. This a reverberatory furnace, also operated by gas fuel. The ingots are put in at a back door and taken out in the front, from whence they make a direct shoot to the rolls.

A striking feature about these works is the application of power to all operations. All lifting is done by hydraulic machinery, and there are numerous special appliances for handling the material throughout the various manipulations. In many rolling mills the machinery in motion rattles and thunders as if a part of its purpose was to grind up the gearing; and the parts are proportioned and put together as if roughness were a distinguishing merit, and fitting a thing to be despised. Here the machinery works quietly and effectively, giving the impression that a master mind had designed it to handle the steel, not to pound its own inwards.

The instant the glowing ingot emerges from the front door of the heating furnace it glides on to a series of rollers which convey it to a table close to the plate-forming rolls. If the ingot reaches this table obliquely men do not attack it with hooked bars to pull it square. It is stopped on a small hydraulic turn-table, which, like the main table and the other machinery, is operated by a man on a raised platform, and is instantly set square for going into the rolls.

The plate rolled from one ingot in each heat is subjected to physical and chemical tests, and the quality of the steel recorded. The whole of the output is controlled by scientific knowledge. Chemistry determines the quality of the iron that shall go into the charge, metallurgical skill regulates the operations of manufacture, and by chemical analysis and carefully conducted physical tests the quality of each heat is ascertained at the finish.

The works are producing about 6,000 tons of open-hearth steel at present. A great portion of this is rolled into plate, but there is also enough cast into ingots for tires, axles and other purposes to make an important industry.

There are two Bessemer converters kept constantly going, and they turn out about 5,000 tons of steel per month.

The business of the company is growing so rapidly that the present works are inadequate to produce sufficient steel to meet the demands, and they are building new works that will nearly double the capacity of open-hearth steel.

A. S.

New York Railroad Club.

The regular monthly meeting of the club was held at the rooms, 113 Liberty street, on Thursday evening, Nov. 17, the President, Mr. C. E. Garey, in the chair. The subjects for discussion were Car Heating, Lighting and Ventilation.

The discussion was confined exclusively to car heating, and was participated in by a number of gentlemen representing some of the systems now before the railroad public, the merits of which were duly presented by their respective advocates.

The following subjects were announced for the next three meetings:

December: The Master Car-Builders' Association Rules of Interchange and Repairs by Contract.

January: Car Wheels and Axles.

February: Automatic Draw-Bars for Freight Cars.

The meeting then adjourned.

The Lafayette (Ind.) Car Works are busy in filling orders for 300 box cars for the St. Joseph & Grand Island road, and 500 coal cars for the Chicago & Indiana coal road. They have just completed 50 34-foot refrigerator cars for the Austell Refrigerator Car Co. (E. G. Spaulding, general manager), Atlanta, Ga. The cars are to be used in the fruit traffic between Florida and Chicago.

Communications.

West Shore Locomotives and Tenders.

Editors National Car and Locomotive Builder:

I noticed in your November number certain statements which seem to me to invite some comment. You speak of the late Mr. Howard Fry having purposely specified small tenders for the West Shore engines, in order to reduce the dead weight to be hauled. Now, the standard West Shore tenders as designed by that gentleman have a water capacity of 3,000 gallons, and space sufficient to carry 14,600 lbs. of coal. The tanks themselves are 8 ft. 8 in. wide × 19 ft. 6 in. long, and the tenders, when fully loaded, weigh 76,000 lbs. Surely, this can not be called "small," even by the greatest stretch of imagination. Again, you mention Mr. Fry's engines as being unpopular on the road, and go on to say that Mr. Soule's eight-wheelers are decidedly the reverse. This is rather remarkable, considering the fact that the latter engines, known as class "E," are in nearly every particular precisely the same as the Fry engines.

It would also be interesting if you would give some further particulars of the Northern Pacific engine, which you mention when speaking of the performance of the Strong engine "Duplex," and which you say hauls, presumably unaided and day in day out, 12 cars up the 3 mile 86-ft. grade just out of St. Paul. From the data given it seems almost incredible that this engine can perform the service, as the following figures show: The engine has 18 × 24 in. cylinders, 60 ft. drivers carrying 60,500 lbs., and a boiler pressure of 135 lbs. The weight of the train of 12 cars may fairly be taken as 750,000 lbs., or $\frac{1}{14}$ of 875,000 lbs., the weight of the 14 cars the Strong engine pulled up the same grade. Adding to this the weight of the engine and tender, which may be approximately taken as 140,000 lbs., the total weight of train becomes 890,000 lbs., or 445 tons.

The resistance due to gravity alone on an 86-ft. grade is $\frac{2000}{86} = 23.2$, say 23 lbs. per ton, and this added to 8 lbs. resistance on the level, makes a total resistance of $\frac{445}{31} = 13.795$ lbs.

To overcome this, a M. E. P. of over 106 lbs. would have to be maintained in the cylinders throughout the three miles of grade, and this, with a boiler pressure of 135 lbs., would be an extremely noteworthy performance. Moreover, the co-efficient of adhesion would have to be $\frac{60,500}{13,795} = \frac{1}{4.3}$ at all times, or the engine would fail to do the work.

W. F. DIXON.

[We have no desire or intention of saying aught against the Fry locomotives, and we merely repeated the words of an official of the road who was in a position to know what he was talking about. The Soule engines, Class E, use as far as possible the interchangeable parts of the Fry engines, but the former have much larger boilers than the latter, and a small change in this respect is likely to greatly influence the popularity of an engine. If our correspondent's data were all correct he would make a point against the probability of the Northern Pacific locomotives doing the work claimed. But the grade referred to is not 86 feet to the mile for three miles or for one mile. The steep part is only about half a mile long.—EDS. N. C. & L. B.]

Formula for Cylinder Proportion.

Editors National Car and Locomotive Builder:

I have never seen any correction of the formula for cylinder proportion as printed in the Report of the Master Mechanics' Association and copied by all the mechanical papers.

$W = \frac{d^2 \times S \times P \times 0.85 \times C}{D}$ would be correct had not the values for the constant C been given as fractions instead of whole numbers.

Making $C = 4$ for passenger, 4.25 for freight and 4.5 for switch engines, instead of $\frac{1}{4}$, $\frac{1}{4\frac{1}{2}}$ and $\frac{1}{4\frac{1}{2}}$ respectively, there will be no trouble in trying to use the rule.

It seems to me that attention should be called to the mistake.

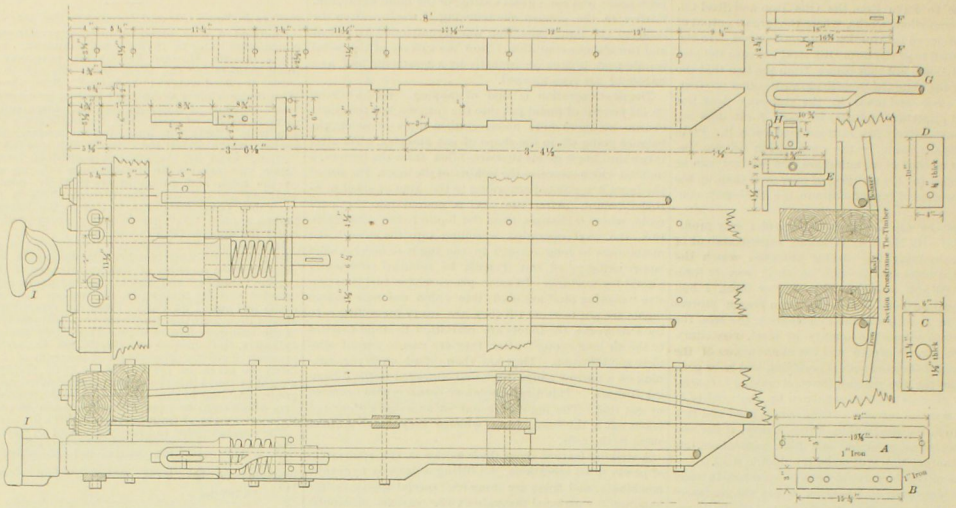
J. N. SANBORN.

ST. LOUIS, MO., Nov., 1887.

New Stock Cars.

Considerable interest was manifested lately by parties in Chicago connected with the shipping of live stock in a train of twenty fine "palace" stock cars on the Chicago & Grand Trunk Railway. The cars are as great an improvement over the common stock car as the drawing room car is over the homeliest emigrant car. They are carried on 42-inch wheels, equipped with Westinghouse air brake and automatic coupler, are provided with facilities for feeding and watering the stock, and have the means of protecting the load from the weather or of opening the car to the full and free circulation of air. Movable partitions are supplied for keeping each animal separate, and these can be rolled up and held in the roof when the car is not loaded with stock. The roof is made the receptacle for the supplies needed by the animals during a journey. The cars are the property of the American Live Stock Express Company, which is largely composed of Western live stock capitalists. The intention is to put several trains of these cars into service and run them at express speed through to the large eastern cities. A sleeping car for the accommodation of the men in charge will be run on each train.

AMERICAN CONTINUOUS DRAW-BAR—OHIO & MISSISSIPPI RAILWAY.



The engraving illustrates a form of continuous draw-bar, invented by Mr. J. P. Coulter, master car-builder of the Ohio & Mississippi Railway, and used very largely on the freight equipment belonging to that and other Southwestern roads. The officers of the various roads where this form of draw-bar has been adopted, speak very highly of it as a means of saving the cars from damage and reducing the expense of running repairs. It appears to have none of the disadvantages raised against the single bar form of continuous draw-bar. As will be seen by the cut, the device consists of two rods which connect with the draw-heads by means of a strong flat key which is secured in the casting. The arrangement is simple, and if anything happens to break or damage one or both of the rods or their connections, the ordinary draw gear remains intact. We think this invention is well worthy of the attention of master car builders, especially those who have very heavy loads to carry in their cars.

Master Car-Builders' Association.

The sub-committee on the Master Car-Builders' type of automatic couplers have issued the following circular:

NEW YORK, Nov. 15, 1887.

The report of the Executive Committee of the Master Car-Builders' Association having been approved by the Association, and the Janney type of coupler having been made the Master Car-Builders' standard, a sub-committee has been appointed by the Executive Committee to consummate the recommendation of the report that "the Association procure one of the present makes of Janney type of coupler, selection being made by a committee appointed for that purpose, and then all other forms of couplers that will couple to and with this coupler, under all conditions of service, are to be considered as within the Janney type and conforming to the standard of this Association."

All parties who claim to manufacture couplers within the Master Car-Builders' type are requested to send two couplers completely finished and ready for service, to R. D. Wade, Superintendent of Motive Power, Richmond & Danville Railroad, 1300 Pennsylvania avenue, Washington, D. C., on or before December 13, 1887. Such parties are further requested to send a representative, to appear before the committee on the above date and at the above place, who will with proper drawings describe the mechanical construction of the coupler he represents, such drawings to remain with the committee and become the permanent property of the Master Car-Builders' Association.

If, in the judgment of the committee, it should become necessary to attach the couplers to cars, the committee will provide cars and facilities for testing, but all expenses incident to attaching the couplers must be defrayed by the owners of the couplers.

The committee will not consider models or drawings or couplers not represented by full-sized couplers ready for attachment to cars as above described.

The committee will make their report to the Executive Committee, who will issue drawings of the Master Car-Builders' type, and officially announce the names of the couplers which are within this type.

The members of the Master Car-Builders' Association are invited to meet with the committee and assist them in their investigation of the various couplers.

EDWARD B. WALL,
R. D. WADE,
JOHN S. LENTZ,
J. W. CLOUD. } Committee.

Grand Trunk Railway Shops at Hamilton.

At Hamilton, Ontario, are located the shops which were the mechanical headquarters of the Great Western Railway of Canada when that was an independent corporation. As most of our readers are aware, the Great Western was swallowed by the Grand Trunk Railway several years ago, and the Hamilton shops are now operated under the latter named railway. Although now merely division shops those at Hamilton, although smaller, are much more convenient for doing work in than the headquarter shops at Montreal; and probably for this reason considerable new work besides very heavy repairs continue to be done here. Mr. C. K. Domville, mechanical superintendent in charge of these shops and this portion of the Grand Trunk system, is able to boast, and he does it with considerable pride, that he has 177 locomotives with parts actually interchangeable. This ought to have great influence in reducing the cost of repairs. Mr. Domville is now engaged in building six of a new class of heavy passenger engines with cylinders 19 × 24. To enable him to get more grate area in the fire-boxes, he uses a combination frame with a slab at the sides of the fire-box. He also spreads the driving-wheels 104 inches between centers to obtain as long a fire-box as possible. Some of the engines that are in service are said to be remarkably free steamers, while being very light on fuel. The ordinary standard engine used on this portion of the Grand Trunk has bar frames, and the mechanical department at Montreal have decided to build no more locomotives with slab frames, although they have many in use, and may be depended upon to judge of the merits of the different kinds of frames. It looked curious to me to see one portion of what is really the same road introducing the practice of building plate frames, while the other portion is abandoning that design. Nearly all the engines on the Great Western division have underhung springs, and Mr. Domville speaks very highly of the satisfaction they give in service. The engines supported in this way ride very well, and broken driving-springs are practically unknown.

The shops are very busy rebuilding freight engines that have become run down. They give the engines new boilers and renew other leading parts if necessary. They consider it cheaper to make a new boiler for an engine if the frames and motion are good, than to sell the whole thing as scrap. The new boilers are larger than the old ones, and the fire-box is longer. The crown sheets are stayed after what is called the "Darby" method, which combines the advantages of the radial screwed stay and the sling stay. The mechanical department find that this method of staying is much superior to the crown bar, for the reason that it is much easier to keep the crown sheet clean. Several engines rebuilt as described have been put into service and are considered equal to new machines.

All departments of these works appear to be well run, and above the average in the means employed for getting out work; but the iron foundry struck me as exceptionally well managed. Some of the cylinders, driving-wheels and other heavy castings turned out there were as fine specimens of the molder's art as any thing that I ever examined. They cast the rim of the driving-wheel without a contraction slot, and they are said to have no cracked wheels, the stresses being all relieved by peculiar skill in casting and cooling. In watching the work, I noticed that shortly after pouring the metal for a driving-wheel they made a water-tight vessel of the axle-hole in the center of the wheel, and kept it full of water. This was evidently done to make the heavy body of iron in the center of the wheel cool as fast as the thinner body composing the rim. The practice may be common, but it was new to me. The foundry turns out wheels enough for all the freight cars used in the Great Western division. Mr. A. A. Maver, assistant to Mr. Domville, is one of the brightest young men I have met during all my ramblings.

A. S.

In Paint-Making Works.

America has more frame houses and railroad cars than all the other continents of the earth combined. There is no immediate connection between frame houses and cars, but they both possess the common necessity of requiring to be painted, and painted at frequent intervals too, if they are to be kept in a condition satisfactory to the owners. This being the case, it will not be regarded as a matter of surprise when the assertion is made that America has, if not the largest paint-making establishment in the world, the establishment where the best paint grinding and mixing machinery ever produced is in daily use. This establishment is the manufactory of the Sherwin Williams Paint Company, in Cleveland, O., the operations of which are on a scale that is quite surprising to most visitors. A great many people contrive in some way to spread paint over wood and canvas, and however badly the operation may be done, it would prove a masterly job in comparison to the performance they would achieve in mixing paints to produce a required color. To make the way of painting easy manufacturers have adopted the practice of preparing and selling paint that is already mixed. The ingredients in mixed paints have a strong affinity for oxygen, which would harden them before their time if the compound is not excluded from the atmosphere. To effect this exclusion, the paint is made up in air-tight cans, and in the Sherwin-Williams establishment the making of the cans is an important industry. All the operations are done by machinery and facilities are provided in the works for making from 25,000 to 30,000 finished cans every ten hours. The magnitude of the operations conducted by the company may be judged by the extent of the can-making plant, yet probably the greater portion of the product is sent away in casks. Besides paint-making and can-making, engraving and printing are carried on within the works for the preparation of sample cards, circulars and labels, that would make a very good business in itself.

In manufacturing the paint, all the material is raised to the upper floors, and during the operations of mixing and grinding keeps going constantly downward toward the point where canning or barreling takes place. The material is carefully weighed and mixed with a certain quantity of oil, and run into the grinding mill, which is designed after the principle of the flour-mill, but improved to suit the conditions of paint grinding. The paint material has to be ground as fine as any flour, and special care has to be exercised to prevent the least trace of grit or lumpy matter from passing into the finished mixture. On one floor there are eleven grinding mills kept constantly at work. So soon as the paint is properly ground it is passed downward into a vat, where it is examined to see that the consistency and shade of color is right. After being kept churned for a few hours the mixture is ready for canning.

The quality of paint manufactured in these works covers all varieties used in the trade, from the coarse iron mixture for freight cars, costing a few cents a pound, to the delicate colors for artists costing as high as fifteen dollars a pound. A surprising feature about these works is the extreme cleanliness that prevails. Although the paint handled is immense, not a drop is found thrown out of place, and there is said to have been no case of illness among the workpeople induced by the paint.

NATIONAL CAR LOCOMOTIVE BUILDER

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BY

R. M. VAN ARSDALE,

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock, construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

The Demand for a New Standard Axle.

Now that the subject of car couplers is out of the range of discussion for the present, and that of automatic air brakes for freight cars is practically settled, it looks as if the next important matter to be taken up and settled by the master car-builders is a standard axle for thirty-ton cars. The rejection of the standard proposed by the Master Car-Builders' Association and sent to letter-ballot by the votes of last convention, does not prove that a standard axle for heavy cars is not wanted, but it merely indicates that the axle proposed did not suit the majority of railroad companies. Many railroads are having cars built to carry twenty-five or thirty tons, and the ordinary M. C. B. standard axle is too light to carry a load of that weight, so it is necessary to put a heavier axle into the service. If the Master Car-Builders' Association do not succeed in settling upon a new standard axle soon, there is danger that great diversity will arise in the forms of axles put under heavy cars, and this would be quite a misfortune to railroad interests.

So far as we can learn by conversations with the parties who helped to reject the proposed standard, the principal objection to the axle was that it deviated too much from the length of the existing standard. The axle proposed was very symmetrical, and admirably proportioned for carrying a heavy load, but it was 2¼ inches longer than the axle which has done so well under moderate loads; and many master car-builders thought that an axle for the heaviest load might be designed which would entail less changes in the truck and housings than the proposed axle called for. We also find that there is a growing leaning towards a collarless axle. Putting a collar on the end of an axle to prevent lateral motion is as unmechanical a means as could be well devised for the purpose, and the mystery is how railroad men have put up so long with the inconvenience and expense resulting therefrom. From the first day a new axle is put in service there is a constant conflict going on between the brass and the collar. The collar grinds down the end of the brass, and the brass cuts the collar out of shape, so that its inroads on the succeeding brasses will be still more formidable. While these operations are going on the friction causes hot boxes, hot boxes delay the trains and part of the friction is in many instances transferred so that there is hard rubbing between the operative and mechanical departments. Another weak point about a collar on the end of an axle is, that when the car makes a heavy lurch sidewise, the brass transfers a great portion of the thrust to the collar and thus the extreme point of the journal is used as a lever to bend the axle.

The interest manifested by the Western Railway Club and the New England Railway Club in this matter of a new standard axle indicates that the question is getting ready for settlement, and their work is likely to help forward the settlement. If the members of these and other clubs should distinctly indicate their preferences in an axle intended to carry very heavy loads, it would prepare the way for the master car-builders reaching a decision that would be satisfactory to the majority of those interested. We do not see why the axle proposed by Mr. J. N. Barr should not be taken as a compromise that would satisfy all parties. That axle used with the box, brass and wedge designed by Mr. Jacob Johann, would make an excellent combination. Mr. J. N. Lauder is running some axles of the M. C. B. standard, but having the journal turned straight the usual thickness of the collar, but without a collar, and he is quite enthusiastic about the way the journal runs. He uses the Johann box with this axle. This box was illustrated in the NATIONAL CAR AND LOCOMOTIVE BUILDER of July last. It was designed to use the M. C. B. standard axle with a straight journal 4½ inches diameter and 8 inches long, giving ample strength for any weight of load that has to be provided for. The axle proposed by Mr. Barr and the box designed by Mr. Johann, appear to us a combination worthy of attention from those looking for a new standard axle, but we leave the decision to the discrimination of the majority, with full assurance that they will select the form of axle best suited to the needs of the roads interested.

Brakes for Six-Wheel Trucks.

We have repeatedly called attention to the necessity for the designing of some simple form of brake gear that would admit of applying brakes to the middle wheels of six-wheel trucks. A week seldom passes without accidents happening which indicate that fast trains made up of cars carried on six-wheel trucks are insufficiently braked, and a source of constant danger even in cases where the leverage is close to the wheel sliding limit. We are now gratified to learn that the mechanical departments of various roads are working on the problem of devising proper mechanism for applying the brakes to all the wheels in six-wheel trucks. Some time ago the mechanical department of the Chicago, Burlington & Quincy road invited the various master mechanics to work on producing the required mechanism. Several designs were presented and are on trial. An arrangement designed by Mr. Joel West is giving satisfaction and promises to be an entire success.

His brake-gear for six or eight-wheel trucks is a modification of the gear used for applying brakes to the drivers of consolidation engines. The Pennsylvania Railroad Company are also experimenting with brake gear designed for six-wheel trucks, their arrangement applying the shoes to the wheels by beams similar to the practice with four-wheel trucks. They find that with a strong steel beam the difficulty of hanging the beams between the wheels can be overcome. The matter is so well worthy of attention, that we earnestly commend all railroads having six-wheel trucks in use to take it up. This is a subject that might very well be considered by the various railroad clubs. The necessity for applying brake shoes to all the wheels of car trucks does not admit of difference of opinion, but mutual help might be obtained in working out the best method of making the application. Those who have worked on the problem might submit drawings for the information of others, and the free ventilation can not fail to result in making the application of brakes to all wheels more general than it is at present.

Increase the Usefulness of Railroad Clubs.

With the advance of the winter months the various railroad clubs have got into working order, and, as usual, the active spirits of each club are exerting themselves to excite interest in the proceedings, and to make successful meetings that shall be valuable to the individual members and profitable to the railroad companies. A forcible drawback which all the railroad clubs labor under is the tendency of members to depend upon their neighbors to perform the active work which gives life to the organization. This tendency is not confined to railroad clubs, for it is felt in all societies where the proceedings are conducted by voluntary effort, but its effects are peculiarly depressing upon clubs that meet at frequent intervals, and must have some living subject well introduced for discussion. If the advantage to railroad men and the benefits to railroad interests arising from the existence of railroad clubs depended entirely on the information gained in the public proceedings, no great loss would be experienced when they became moribund through want of subjects to talk about; but railroad interests are best served by the understandings arrived at when officers of different roads meet at frequent intervals. The life of the clubs is worth preserving for this alone, and when it is worth preserving it is worth infusing energy into. Those familiar with the internal working of our clubs are aware that it is an exceedingly difficult matter to select good subjects for discussion, and even more difficult still to find members ready to prepare themselves with the data needed to make a good opening address. For the last year the Western Railway Club has followed the practice of selecting the questions for discussion a month in advance of each meeting, and also of appointing a member to introduce each subject, and this has generally been done by the reading of a short paper presenting the salient facts of the subject, as seen from the stand-point of the speaker. The New England Railroad Club has depended upon the voluntary efforts of some member present at the meeting to introduce the subject selected for consideration; and as railroad men are not, as a rule, walking encyclopedias ready at a moment's notice to diffuse full and accurate information on any subject suggested, the practice of depending upon unprepared speakers to open the proceedings has not proved a success. They are now about to adopt the Western Railway Club practice of appointing speakers in advance, and there is no doubt but the change will be a benefit to the members.

The leading difficulty experienced by railroad clubs in the efforts to make the proceedings valuable, is the paucity of subjects that are not tongue-threshed threadbare. Mr. G. W. Rhodes, President of the Western Railway Club, made some suggestions on this subject which are well worthy of the attention of those who are striving to keep railroad clubs in a vigorous and useful condition. The gist of the suggestions are embodied in the following note added by the secretary to last announcement of meeting:

"The investigations and experience of railroad officers often bring out incomplete information, which might frequently be supplemented advantageously by facts in the same line discovered by others. Short papers, on subjects of this character, that could be read in about five minutes, might be easily prepared and would be the basis for valuable discussions. The Executive Committee wish to urge members and others having information of this kind to present it in the way suggested."

Hitherto the officers of the mechanical departments have formed the principal members of railroad clubs, but there is no reason why the operative and engineering departments should not take part in the proceedings. There are many subjects of mutual interest to the members of different railroad departments, and the preparation of short papers by the engineers or traffic superintendents on subjects which they are interested in, in common with master mechanics and car-builders, would lead to increased harmony and in many cases would be a benefit to the road. On numerous roads there is difference of opinion and distracting sentiments among the officers of different departments on matters where harmony is desirable in the interests of the company. Many things done in locomotive and car construction that have proved injurious to track and bridges might have been avoided by a little more intercourse between the mechanical and engineering departments. Chronic misunderstandings that exist between operating and mechanical departments about the use and abuse of engines and cars, and the handling of men, might be dissipated if both sides could be got into a meeting where they might reason together. If an engineer thinks that the spring arrangement of certain cars that frequently pass over his road is so rigid that the wheels strike uncushioned blows dangerous to the rails, a railroad club meeting would be a good place to ventilate the matter, and it would interest all parties as much as questions relating to car interchange. Where a division superintendent or train master gets imbued with the consciousness that the master mechanic is making the cylinders of his engines too small, he would receive the views of men well able to judge on the merits of the case, if he submitted locomotive proportions for discussion at the nearest railroad club.

Manufacturers of railroad supplies also are often possessed of special information that would be interesting and valuable to railroad men. When Mr. M. N. Forney was secretary of the New York Car-Builders' Club he made very successful meetings by inviting such men as Mr. Coleman Sellers to address the club on subjects which railroad men were interested in. A similar practice might be followed with advantage in inviting friends of the clubs to read the short papers already alluded to. The paper which Mr. W. L. Brown, chemist of the Chicago, Burlington & Quincy Railroad, read at the last meeting of the Western Railway Club on "The Relative Strength of Sap and Heart in Norway Pine" was a good beginning. The example is well worth imitation.

The Annual Scarcity of Cars.

About this time every year there is a great outcry about the scarcity of freight cars. If the markets are active and there is no unusual stagnation in general business, the annual car famine may be looked for with as much certainty as the fall elections. The daily papers are full of startling paragraphs about it, and the railroad journals are expected to sift the matter to the bottom, point out the cause, and suggest a remedy so effective that if the thing ever occurs again, the railroads will be taken in hand and made to feel the force of coercive legislation. As to the cause, the natural conclusion is that there are not cars enough, and that the only remedy is to build more cars at once, say 200,000 or less, or enough to provide against the contingency of a famine next year. We readily admit that if cars are to be used and abused, and accounted for in the future just as they have been in the past and are now, there is no other practicable way of preventing a periodical scarcity such as now exists.

But is there an actual insufficiency of cars relatively to the tonnage to be transported? This, of course, can not be determined with any very near approach to accuracy, owing to the want of reliable data. But according to current estimates, the correctness of which is not questioned, there is at present an average of seven freight cars to every mile of road operated in the United States, their distribution being in accordance with the requirements of traffic, the heavy lines averaging very much more than this per mile, and the light ones very much less. Saying nothing about the different kinds and classes of cars, it really would seem that if this enormous aggregate were handled with business-like promptness there would be no scarcity even when the rush comes. Everybody knows what a vast number of freight cars stand idle for months

during the dull season, representing for the time being so much unproductive capital and accumulating interest, and it is natural to suppose that these cars are all busy in a time of scarcity. But such is not the case. Cars are held from service upon all sorts of pretexts. It may be considered necessary on account of competition, or the demands of a road division, or of this, that or the other department, to provide against an anticipated need that may or may not occur. But one of the chief causes of detention which helps to bring about an apparent scarcity, is the numerous delays in unloading at terminals and points of destination. Cars are turned into warehouses and stand idle on side tracks day after day, owing to the lack of facilities for the prompt handling of freight, and this in the aggregate makes a great difference in the number available for service. A car earns nothing when it is not moving. To earn revenue, it must move paying freight, or move empty toward a point where such freight can be obtained.

A system of accounting that would be a reliable record of the stops and movements of each individual car would enable every road to know how many of its cars are standing idle at any particular time, and to that extent would account for any real or apparent scarcity and suggest a remedy. Such a system would involve expense, to be sure, and so would the alternative of providing a sufficient or an excessive supply of cars against an anticipated need. It is not likely, however, that a better and more expensive accounting system will be generally adopted very soon, nor is it probable that there will be any greater activity in the building of new cars to meet a prospective demand than has prevailed during the past year. It may therefore be expected with reasonable certainty that the usual annual scarcity will occur again next year, if the crops, markets and general business continue without any unlooked for change

Money-Making Cars.

Three years ago the Old Colony Railroad Company equipped twenty five of their freight cars with air brakes, so that they might be made up into a train to be used in conveying fast freight to and from the Fall River steamers and run safely at something approaching express train speed. About eighteen or twenty cars are generally put in the train and the service has been so well managed and so successful that the cars have undoubtedly earned more money for their owners in the three years they have been running than any other train of freight cars ever operated. It appears that the prompt way the freight is handled ought to convey valuable lessons on transportation capable of wide application. The cars are loaded in Boston in time to leave for Fall River at 2:45 P. M., and the run to that point of transfer is made in about ninety minutes. The cars are immediately run into the warehouse and unloaded into the boat which leaves for New York in the evening. The cars remain in the warehouse till the arrival of the boat from New York in the morning, and they are then loaded, and start for Boston about 8 A. M. The train gets to its destination to have the load discharged, and another load put in before 2:45 P. M., the next leaving time. The operation moves as regularly as clock-work. Sometimes cars without air brakes from other roads come in and have to be pushed through on the fast freight train, and they are placed behind those with brakes. On one occasion, when the train was made up in this way, the train broke in two through a defective link, but there was no damage done in stopping. In fact, the front portion did not get far enough away from the hind part to cause any shock. The cars are of the ordinary standard belonging to the road, having iron trucks with swing beam, and carried on elliptic springs. The only extra thing about the cars is the air-brake, and it has cost practically nothing for repairs. According to the words of the superintendent of motive power, "we do not know that the brake is there except when we want to stop the train."

Local Travel in New York and Brooklyn.

The facilties for passenger transportation in the city of New York are becoming every year more inadequate to meet the increasing demand. The elevated lines are already burdened with a traffic during morning and evening hours that far exceeds the seating capacity of the cars. The rush is getting to be so great at such times that it is considered quite a privilege to obtain standing room in the passage ways or on the car platforms. If the travel could be more evenly distributed through the day the congestion would be relieved, temporarily at least. But this is out of the question. No more trains can be run safely mornings and evenings than are now run, and their length cannot be increased without increasing the length of the station platforms. In the meantime, the demand upon the roads is increasing every year at a compound ratio. The number of passenger carried during the year ending Sept. 30, 1884, was in round numbers 96 millions, in 1884-85 it had increased to 103 millions, in 1885-6 to 115 millions, and in 1886-7 according to the company's report just issued, to 138 millions, the increase during the last year greatly exceeding all previous ratios and pointing to a future growth of traffic that is quite incalculable rom any present data. The street surface lines, or horse roads, carried in 1883-4, 187 million passengers and 210 millions in 1885-86. At this rate of increase upon elevated and surface lines, it is manifest that additional facilities of some kind must very soon be provided, or the means of local transit for passengers will have reached their limit, and the result will be a crisis, the gravity of which will be more fully realized a year or two hence. There is still standing room on the surface lines, which can be made available while it lasts for the overflow from the elevated trains.

The demand for local transit in Brooklyn is also increasing very nearly at a corresponding rate, and elevated roads are being rapidly constructed through several of the principal avenues of that city, all of them terminating at the bridge and a single ferry hardly a stone's-throw from it. The bridge's cable cars carried in 1885, in round numbers, 17 million passengers, and 3¼ million crossed by the footway. In 1886 the cars carried 24 million, and 3 million crossed over the footway. The current year will, undoubtedly, show a still larger percentage of increase. The elevated roads, reaching in various directions far out into the suburbs, will be completed in a few months, and some of them in less time. These, and the present surface lines, will concentrate larger and constantly increasing numbers at the bridge and ferry, especially during the morning and evening hours, and it remains to be seen how the crush will be disposed of. The capacity of the footway is still far from being exhausted, and the ferry can not, without additional slips, do much more than it is now doing. The bridge cars are the great reliance, and all the resources of mechanical ingenuity are being brought to bear to increase the length of trains, make them move faster, load and unload quicker, and transport more passengers per hour than they now do. Nothing short of this will meet the impending emergency. It would seem that, by a different arrangement of the bridge platforms, a train might be loaded and unloaded at one stop, the time between trains being gauged to the smallest limit of safety, and enabling the unloaded passengers to get off the platforms (which are now much narrower than they should be) before the following train comes to a stop.

Helping Legislation Against the Car Stove.

Some railroad companies are complaining with considerable show of reason about the indiscriminating character of legislation, past and prospective, regarding the presence of stoves in passenger cars. They make out the case that they have equipped all their passenger cars with safety heaters that have never caused a fire in a wreck, or with strong well-cased stoves that have the best appliances for preventing the starting of fire in case of accident. They complain that it is unfair that they should be put to vast expense and great inconvenience because other roads less enterprising or less impressed with their duty towards the traveling public, have continued to use weak and dangerous stoves which they decline to abandon unless compelled by legislation to do so. The burning of passenger trains has been such a common sequel of late years to accidents which otherwise would have proved comparatively harmless, that legislators can scarcely be blamed for passing enactments which will compel railroad companies to make every possible provision against roasting the people they have engaged to carry safely, for it is notorious that no lesson of disaster has been strong enough to induce many railroad companies to part with the use of the most fragile and dangerous stove which continued to be dear to the officers in charge because it was cheap in the first instance.

But the short-sighted action of this class of railroad managers is not alone responsible for special legislation against the stove. Those who have adopted good, safe heaters for their passenger cars, have in many cases left the old stove in the baggage and express cars, thereby retaining a source of danger in the place where it was most likely to find means of doing mischief should a wreck occur. The writer was recently traveling on a well known road, noted for the excellence of its rolling stock and for its general progressiveness. The cars were handsomely finished, kept admirably clean, and the heaters in the cars appeared all that could be desired to combine comfort, simplicity and safety. Each car was carefully examed in turn with the impression that the writer had found an ideal train; and full of such thoughts he walked into the baggage car to visit an old acquaintance who was doing the baggage smashing on that train. The day was cold, and the baggage master was in the humor to keep himself and the contents of the car warm. The car was provided with a plain globular cast-iron stove, without any casing. The globe, familiarly called the pot, was kept red hot till the car got uncomfortably hot, and then the door of the stove was thrown open to check the rise of temperature. It needed no great stretch of imagination to conceive what would happen if a broken rail or any other of the by no means uncommon incidents of railroad operating should lead to the smashing of the baggage car with the remainder of the train on top of it. Our friend, the baggage man, was disposed to fight past battles of railroad life and linger on reminiscences of other days. But the red hot stove, the open door, a high rate of speed and some rough track we happened to reach, were all too suggestive, and we felt that urgent business required our presence in the sleeping car. Since that day we have not felt disposed to question the justice of the tendency of legislation to make a clean sweep of the car stove.

Railroad Building for the Current Year.

A new construction yet to be reported will in all probability make the total mileage for the current year somewhat greater than that of 1882, when it reached the unprecedented figure of 11,568 miles. In view of the reaction which followed the remarkable activity of that year, which was considered so excessive as to be called a "boom," the question may be asked whether the new mileage of the present year is equally deserving of that significant appellation, and that a period of dullness is likely to follow similar to that of 1884-5. Predictions as to the future based upon precedents of former reactions would be hazarduous and likely to mislead, owing to the changed conditions existing during the past year as compared with previous periods of overconstruction. The new construction, although large in the aggregate, has not been the outcome of a mania. There has been nothing spasmodic about it, nor has it been stimulated to any marked extent by a contagious spirit of speculation. The arena of greatest activity has been just where it was to be looked for to meet the requirements of a growing and prospective traffic—the newly settled regions of the West and Northwest. Here the most important additions have been made to the previous mileage, while east of the Mississippi River the new construction has been almost entirely confined to short lines and extensions of a local kind. The new roads have been built for the most part with legitimate capital, or backed by the credit of powerful companies, the situation in this respect presenting a marked contrast with the state of things in 1882. Another element which should not be overlooked in the comparison is the reduced cost of the recent construction in consequence of the lower rates of wages and prices of materials, which relatively increases the earnings and percentage of dividends.

Favorable as the outlook appears to be when viewed in this light, it can hardly be expected that next year's mileage will equal that of the present year. If the Wall street barometer experiences no violent fluctuations, and no unlooked for financial revulsion shall occur, the railroad construction for the coming year will doubtless show a healthy falling off, and nothing more. This is what all prudent and conservative business men expect in view of the exceptionally large mileage of 1887. The general prosperity never suffers from timely contraction, but from abnormal expansion. There has been no "boom" this year in the popular signification of the term, and this justifies the hope that there will be none next year.

Evading the Interstate Law by Under-Billing.

There is every reason to believe that the working of the Interstate law has in some quarters led to the systematic under-billing of freight. There is said to be more ways of killing a cat than by choking it with butter, and the freight agents appear to recognize the fact that there are more ways of favoring shippers whose patronage they are willing to cultivate by law breaking, than by giving them the forbidden rebates on freight charges. Giving rebates on freight charges was an awkward method of favoring the large shipper at the expense of the smaller one, but it was not open to some of the disadvantages of under-billing. The men who attended to the giving of illegal rebates might receive training in dishonesty that would be likely to bear evil fruit in its season; but the practice would scarcely be more demoralizing than that of daily making the false representation that a ton was only one thousand pounds or less. The latter practice also entails a cause of danger from which the former was free. Cars are liable to be so overloaded that dangerous accidents will result. We recently learned particulars of a case where the axle of a car broke, causing considerable damage. The car was billed to contain 23,000 pounds and the actual load was found to be 58,000 pounds. This is too great a difference between the pretended and real load, which indicates that the men who are engaged in this means of cheating are blunderers in the art they are cultivating. Railroad managers ought to see to it that general freight agents who undertake to beat their competitors by under-billing do not get the companies they represent into serious trouble. For instance: A car is stenciled to carry 30,000 pounds, which is implied to be the safe load. To meet the plan of under-billing, a load of 50,000 pounds is put into the car, and before it reaches its destination an axle breaks, killing one or more trainmen. When this or a similar case happens, and it will come in time if the practice is persisted in, some one will be liable to be tried for manslaughter. It is a pity some one could not be convicted of murder.

The Chicago & Alton has lately built at its Bloomington shops two passenger coaches mounted on 6-wheeled trucks, with 42-in. Allen paper wheels, and measure 64 ft. 7 in. over bodies, and 73 ft. 6 in. over all. Four handsome chair cars, recently finished, weigh 82,000 lbs. each, and measure 61 ft. 2 in. over bodies. Two similar, but smaller chair cars are under construction. This road has lately added to its equipment 219 coal cars, 34 ft. long, and 50,000 lbs. capacity, and 225 stock cars, 35 ft. long.

WE print elsewhere the circular of the sub-committee appointed by the Executive Committee of the Master Car-Builders' Association, to arrange for making a selection of such car couplers as conform to the Janney type, or that will couple to or with this type. The sub-committee request that parties claiming to manufacture couplers of this kind, send two of them finished and ready for service to Washington, D. C., on or before Dec. 13, with a person to represent and describe such couplers. The sub committee will then make their report of the result to the Executive Committee, who will issue drawings of the Master Car-Builders' type, and officially announce the names of the couplers which are within this type. This seems to indicate that the time is not distant when this long agitated question will be set at rest, so far as the action of the association can be made instrumental in doing it.

Connect the Conductor's Valve with the Cab.

The superintendent of motive power of a prominent railroad, one of the ablest men of his class, writes :

"Noting the many accidents that have occurred of late, and still another just reported in which we are interested (*i. e.*, failure of air brakes), it has been suggested that if the conductor's valve was connected to cab of engine, where enginemen could reach it, that many of the reported failures of air-brakes would not happen. I can see no objection to this and in my opinion it would be a good idea. You know how useless trainmen are when the alarm for brakes is sounded, they are sure to forget the conductor's valve and run for the hand-brakes which are of very little use. Now I wish to call your attention to a case reported to me a few days ago. A tramp got on the front end of a baggage car and for spite work, it is supposed, turned the air cock, cutting out the engine from train. An emergency stop was required soon after, and the brakes failed to work,an accident occurred causing some damage. This train was stopped but a few miles back of where the accident occurred, and where brakes worked all right. Here is one accident that could have been avoided had the engineer had control of the *safety valve*. There may be some objections to this plan, but I know of none, and I am of the opinion that had the engineman the cord in his cab when the last one occurred, he would have avoided the collision. I am writing this with the hope it may lead to some thorough inspection of the cause of the failure of brakes, as there is very rarely any good conclusion arrived at as to cause of failure. I do not wish to be quoted in this matter, but as I know you are interested in the air brake, you can work up some suggestions for the benefit of all. Has this ever occurred to you? Will you give me your idea of the scheme? I think some of trying it on our trains."

[We can see no objection to the plan proposed by our correspondent, except that it is putting on an extra emergency appliance to meet a source of danger which arises so seldom that the thing is liable to fall into innocuus desuetude before its utility becomes demonstrated. We think a better plan would be to give trainmen more instruction and training respecting the use and care of air brakes than they habitually receive. With all the writing and all the talking that has been done respecting the necessity for trainmen understanding the mechanism that secures the safety of the traveling public, the fact is that on the majority of roads the trainmen do not understand enough about the air brake to enable them to tell when the conductor's valve ought to be applied. On a few of the most progressive roads aspirants for the position of conductor are taken into the office of the superintendent and examined as to their knowledge of train rules, but we do not know of any case where this examination includes the question, what would you do on a passenger train if the engineer called for brakes? The conductors and brakemen of passenger trains ought to be instructed that their first duty on hearing a call for brakes is to open the conductor's valve, but that information is supposed to go to them by instinct and in too many cases it does not get there. We favor the introduction of every appliance and precaution calculated to make train operating bloodless, but we are very strongly impressed with the belief that the most urgent necessity existing at present is for the training of the men in charge of trains so that they shall understand how to use existing appliances.—EDITORS NATIONAL CAR AND LOCOMOTIVE BUILDER.]

A Question of Car Interchange.

A correspondent submits the following case for our opinion :

"We received a car from a foreign road which had a self-coupler on one end and a common draw-bar on the other. The owner of that car now wants us to put on a self-coupler, holding that we are responsible because we received the car. We refuse to do so for the following reasons :

"1st. There is no rule making it a reason why a car may be rejected if, as in this case, both draw-bars are competent to fill their purpose as draw-bars.

"2d. We did not injure either draw-bar.

"3d. There is a rule providing that the road which did repair the car with different material from the standards is responsible to the owners, and therefore the owner should look to that road for repairing the car.

"4th. The common law requires that all actions or suits must be preceded by a proper notice to the parties interested, and as this is common-sense we have no knowledge or notice of what the standards of the owners were; could not tell whether the automatic coupler or common draw-bar was their standard.

"5th. That the car had not the customary name of the automatic coupler stenciled on its side near the end to indicate that it was the standard.

"6th. That we can not be held responsible until the owners send us a drawing for each of our inspectors, showing what their standards are, inasmuch as we are not mind readers and can not get at it by any occult means.

"7th. That to protect ourselves we would have to jack up every car offered us to examine center-plates, side-bearings, brasses, etc., to see if they agreed with standards, which would interfere with business.

"8th. That where a rule does require that the road repairing a car with foreign material should 'card' it, there is no rule stated or implied indicating that an innocent road taking a car without a card is responsible, unless it can be shown that they were served with proper notice and drawings showing what the standards of the road owning the car are.

"9th. That it is manifestly impossible that a Western road can know in any way what the standards of all Eastern roads are, and it is absured to suppose they can determine this in the absence of notices or drawings, and even any lettering on the car to show what is standard."

[Our correspondent, who is one of the most intelligent master mechanics in the country, falls into a very common error, caused by not properly studying the Rules of Interchange of Cars. We do not pretend to know the status of the case at common law, but according to the Rules of Interchange, the road which receives a car repaired with foreign material without being "carded," is reponsible to the owners of the car for the supply of standard material needed to do the repairs properly.—EDS. NATIONAL CAR AND LOCOMOTIVE BUILDER.]

MR. JAMES MCCREIGHTON, who has for many years been connected in various capacities with railroad business and management, died at his residence in West Philadelphia, Nov. 20, aged 54 years. After holding a number of positions connected with transportation affairs, he was in 1865 appointed general agent in charge of the Pennsylvania Railroad Co.'s interests in Pittsburgh, and subsequently superintendent of the West Pennsylvania division, general freight agent, manager of the Empire Line, president of the Baltimore & Ohio East Side Railroad, and of the Ohio Valley Natural Gas Co., which last position he held at the time of his death. During his prolonged service he made many friends, to whom his loss will be a severe affliction. He was buried at Pittsburgh (the place of his birth) Nov. 23, and leaves a widow and three children.

The Central Railway Club.

This club meets on the fourth Wednesday of January, March, May, August and October. The President is Mr. Thomas Sutherland, Master Car-Builder Cincago & Grand Trunk, Detroit. The Secretary is Mr. E. Chamberlain, Master Car-Builder New York Central, Buffalo, N. Y. The membership is about 60. The meetings have always been quite informal, and although the club is older than perhaps any other of the local railroad clubs, it was formally organized only last spring. The subjects discussed have always been rather those of administration and organization than mechanical. In fact the meetings have been held principally for the adjustment of differences of opinion and practice among the officers of the roads centering in Buffalo. The headquarters of the club are at Buffalo, although the membership includes a good many officers who are stationed at some distance from that city.

THE MARTIN ANTI-FIRE CAR HEATER CO., Dunkirk, N. Y., have issued a complete illustrated and descriptive catalogue of their system of continuous train heating for passenger cars. The engravings are of superior excellence, and represent the principal working parts so clearly that the operation of the system can be easily understood. The steam from which the heat is derived is taken from the dome of the locomotive and conducted through the train by methods which secure a proper distribution of the heat without danger from fire or from scalding in case of accident. The construction is simple, serviceable and economical, the cost per car being $200, including every thing. The catalogue contains 48 pages, 11½ × 9 inches, including margin, and also the names of a number of prominent roads upon which the system is in successful operation, after being subjected to thorough preliminary tests.

THE PAGE BELTING COMPANY, Concord, N. H., are extensively engaged in the manufacture of a superior quality of raw-hide belting. A raw-hide belt has many advantages over tanned leather belting for many uses, especially where machinery runs at very high speed, as in the case of planers and similar woodworking machines. This belt is fully described in their catalogue, and in their pamphlet called "Kinds and Grades of Belting to Use for Different Kinds of Work." It is tanned on the surface with bark, and the inner portion is treated by a mechanical process exclusively their own, by which the raw-hide is cured so that the combination of tanned surface and raw material makes a most admirable belt. The selection of the hide and the particular portion of the hide put into this belt is made with the utmost care; none but over weight hides and the very solid part are used. The belts are wire-sewed in the laps of the single, and on the edges of the double, by a special wire sewing machine. This mechanical process by which the interior of the hide is cured is the same as that employed by the company in the manufacture of the "Hercules Lacing," now becoming well known as the leading article in its line.

MR. A. K. MANSFIELD has removed from Chicago to 280 Broadway, New York, where he has associated with his brother, Mr. George L. Mansfield, in the business of mechanical engineering and expert patent work. Mr. A. K. Mansfield was formerly superintendent of motive power and machinery on one of our important railroads, while Mr. George L. Mansfield has been for a number of years employed in the construction department of the Pullman Car Co. Their familiarity with railway mechanics will commend this firm to railroad men who are interested in patenting devices of their own or others inventions, or in getting up machinery or specifications where outside help is desirable. The critical analysis of mechanical movements and construction which goes to make an efficient designer or builder of machinery is a very important quality for one to possess who follows the business of preparing specifications and prosecuting claims for patentable improvements in machinery.

THE ADAMS & WESTLAKE CO., of Chicago, have issued an illustrated descriptive catalogue of 168 pages, containing a full list of articles of their manufacture, with prices, sizes, qualities and other information needed by purchasers. The leading specialties of this company are car lamps, lanterns and locomotive headlights, the merits of which are well established and widely recognized. The catalogue embraces every class of lighting material required for the equipment of a railroad; also a variety of other articles, such as water-coolers, oil tanks, fire extinguishers, spittoons, etc. The car lamps are of various designs and styles of finish, combining utility, ornament and safety. The company also give special attention to signals and signal lamps for every branch of railroad service, and can furnish patterns when required in addition to those shown in the catalogue. The general office and works are at 110 Ontario street, Chicago; Eastern office, 115 Broadway, New York.

THE STEWART & MATTSON MANUFACTURING CO., of Philadelphia, have issued a new illustrated calalogue and price-list of railroad car trimmings and brass ship work. The list includes sash and door locks, window and bell-cord fixtures, basket racks, bronze castings, brackets, hinges, etc, of the latest designs, the varieties of which are shown in large and well-executed engravings. The catalogue contains only a small part of the line of goods made by the company, most of the old styles of trimmings being omitted to save space. The volume contains 127 pages, 9 × 11 inches, and a separate index for car trimmings and ship hardware. Special designs are furnished to customers at moderate prices. The long experience of this company in this line of manufacture, and the reputation of their goods for service, make their present catalogue an attractive one for consumers of the products named.

HILL, CLARKE & CO., Boston, Mass., have issued a voluminous illustrated catalogue of iron-working machine tools, with descriptive details as to capacity, weight, prices, etc., of each. The catalogue includes lathes, chucks, planers, reamers, pulley-machinery, steam and helve hammers, milling, drilling, bolt cutting and nut tapping machines, hand and power shapers, etc., of the different kinds and classes, all made at shops of established reputation and sold at manufacturers' lowest rates. The company are also dealers in steam engines, pumps, boilers, wood-working machinery, shafting, belting and machinists' supplies. The volume contains 280 pages, also a copious index. A copy will be sent to any railroad master mechanic or official upon application to the company, 156 Oliver street, Boston.

THE DAYTON MANUFACTURING CO., of Dayton, Ohio, have published a general catalogue of 328 pages, containing over 1,600 illustrations with accompanying descriptions of articles used in the construction of railroad cars. The engravings are admirably executed, and the descriptive lists very complete in detail and arrangement. As a reference book for car furnishings and trimmings it is not surpassed by any publication of the kind extant, and will be found very useful to car-builders. It contains a complete table of contents, comprising nearly 700 articles, and also a table to enable purchasers to designate any desired style of finish when ordering goods.

THE STANDARD STEEL CASTING CO., Thurlow, Pa., have commenced the construction of an addition to their works, 130 by 95 feet, and will put in a traveling crane of 30 tons capacity. The company will also build a new open-hearth steel furnace, which, with their present one of 10 tons, will enable them to handle very large castings.

MR. C. H. DUNHAM, of the Dunham Manufacturing Co., now on a Western trip, going as far as Omaha, reports good sales of the Dunham Storm-Proof Freight Car Door, as well as several roads that are trying it.

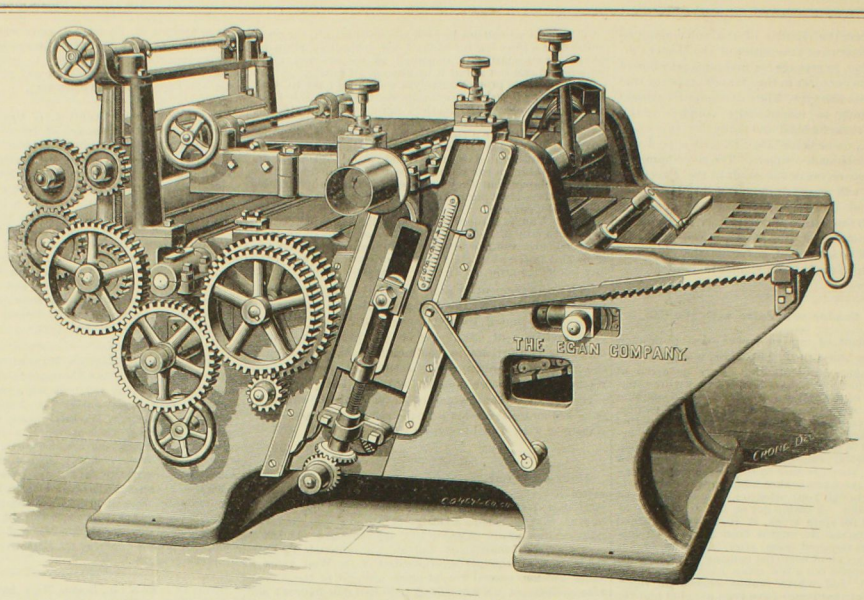
THE RUE INJECTOR CO., of Philadelphia, owing to increased business, are removing their works to 116 North Ninth street, of that city.

The Railway World have removed from 19 Southhaigh t estre to their new offices, No. 420 Library street, Philadelphia.

The Universal Tinker and Amateur's Assistant is the name of a new monthly journal, an earlier notice of which in our columns has been inadvertently omitted. It is a publication that can not fail of being serviceable to a large class of readers and particularly amateurs who are in need of aid and encouragement in matters pertaining to practical mechanics and the wide range of artistic design, experimental, constructive, decorative, etc. Although each number is largely illustrated with diagrams, designs and working drawings, the publication is not a picture-book, but a record of amateur effort well calculated to stimulate invention and prove valuable for future reference as well. Published by Hodgson & Bertrand, 294 Broadway, New York.

The Steam Engine Catechism, fifth and enlarged edition. By Robert Grimshaw, M. E. John Wiley & Sons, 15 Astor Place, New York. This book is intended to give information in reference to the steam engine, without "mathematical gymnastics" and technical formulas. The volume contains 192 pages, 5 × 3½ inches, including margin. Price, post paid to any address, one dollar.

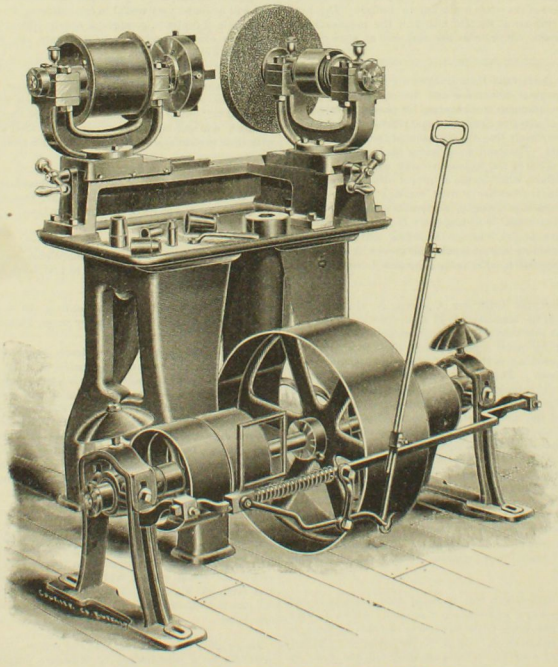
The primary colors are red, blue and yellow. The secondaries, produced by a combination of these, are purple (red and blue) green (blue and yellow) and orange (red and yellow). Blue is contrasted by red and yellow, or orange; red is contrasted by blue and yellow, or green; yellow is contrasted by red and blue, or purple. Orange, or red and yellow, is contrasted by blue; green, or blue and yellow, is contrasted by red; purple, or red and blue, is contrasted by yellow,



NEW DOUBLE CYLINDER ENDLESS BED SURFACER.

The engraving represents a new double surfacer with cylinder to raise and lower, and with a pair of feeding-out rolls for the lower cylinder. The frame is of a new design, and is made in such a way that it is stronger for its weight than any other machine, as it is braced and ribbed on the inside, which makes it very stiff and solid, and is so arranged that the working parts are all easily got at. The main cylinder raises and lowers by a crank from the working end of the machine. This cylinder is double belted, and the lips are of the very best cast-steel and are brought up in such a manner that the knives hug them very firmly. The lower cylinder is on a standard bed and has an independent adjustment for a heavy or light cut. The feed on this machine is very powerful, and the board is fed entirely through without the aid of the operator. The feeding rolls for feeding out the board are geared in the most superior manner, and make a very powerful feed which takes the board entirely through the machine. This will be found a great convenience. The pressure rolls are firmly weighted and hold the board solidly on a traveling bed. The bed frame being stationary, the slats are gibbed in the most improved manner, so that by no possible means can the ends of them be thrown into the cylinder. The broken roll is a great improvement on this machine and works on an improved principle. Two boards of uneven thickness can be fed through the machine at the same time. The capacity of the machine is extraordinary, and for first-class planing in either hard or soft wood, it is said to excel any machine yet placed on the market. The manufacturers build two sizes of this machine: No. 1 to plane 26 inches wide and 10 inches thick, and No. 2 to plane 30 inches wide and 10 inches thick, which are furnished either with or without feeding-out rolls.

Manufactured by The Egan Company, Cincinnati, O.



MACHINE FOR GRINDING PUNCHES AND DIES.

The engraving represents a machine for grinding punches and dies, such as are used in making bolts, rivets, screws, and a large variety of square or circular pieces requiring one or more finished faces. It works equally well on hard steel, chilled iron or softer metals. One of the heads carries a universal chuck for holding and revolving the pieces to be ground, and the other an emery wheel. Both of the heads run on a dove-tailed track and are fed in and out by a screw, making it so that convex, concave or flat faces can be well and quickly ground. A stop can be arranged so that the work can be ground to any desired thickness, or several pieces ground to the same thickness.

It is manufactured by the Springfield Glue and Emery Wheel Co., Springfield, Mass.

Our Directory.

We note the following changes since our last issue. Our readers will do us a great favor by giving us prompt notice of any changes that may come to their knowledge or of any error that may be noticed in our list :

Boston & Albany.—W. R. Robeson, Jr., has been appointed Division Superintendent at East Albany, vice W. H. Russell, Jr., resigned.

Buffalo, Rochester & Pittsburgh.—James T. Gardner has resigned the position of General Superintendent of this road. George C. Payne has been appointed Master Car-Builder.

Chicago, Burlington & Quincy.—C. C. Upham has been appointed Superintendent of the Illinois lines of this company, vice C. F. Resseguie, resigned.

Chicago, St. Paul, Minneapolis & Omaha.—W. A. Scott, late of the Chicago & Northwestern, has been appointed General Superintendent.

Chicago & Atlantic.—Benjamin Thomas, formerly of the New York, Lake Erie & Western, has been appointed General Superintendent, vice F. Broughton, resigned.

Chicago & Northwestern.—G. F. Bidwell has been appointed Superintendent of the Madison Division, vice W. A. Scott, resigned. H. M. Hughes has been appointed Superintendent of the Northern Iowa Division, vice G. F. Bidwell, transferred.

Cincinnati, Indianapolis, St. Louis & Chicago.—Geo. W. Bender has been appointed Superintendent, vice J. W. Sherwood, resigned.

Fort Worth & Denver City.—C. F. Meek has been appointed General Manager of this road, and also of the Denver, Texas & Gulf. R. G. Duncan has been appointed General Superintendent.

Indianapolis, Decatur & Springfield.—C. E. Boyle has been appointed Superintendent, vice Geo. W. Bender, resigned.

Kansas City, Memphis & Birmingham.—J. C. Monroe has been appointed Master Mechanic. He was recently on the Missouri Pacific.

Little Rock & Memphis.—This is the name of the road formerly known as the Memphis & Little Rock. A. Gordon Jones has been appointed Superintendent.

Minnesota & Northwestern.—Wilbert Irwin has been appointed Superintendent of the Dubuque Division.

Northern Pacific.—S. R. Ainsley, Superintendent of the East and West Minnesota and Wisconsin Divisions, succeeds J. T. Odell as Assistant General Manager of the Eastern Division.

Pittsburgh, Fort Wayne & Chicago.—F. D. Casanave has been appointed Superintendent of Motive Power, vice Joseph Wood promoted; and George L. Potter has been appointed Master Mechanic vice F. D. Casanave promoted.

Pittsburgh, Marion & Chicago.—N. F. Wood has been appointed General Manager, vice C. D. Clark resigned. The office of Superintendent has been abolished.

St. Louis, Des Moines & Northern.—L. F. Martin has been appointed Superintendent, vice C. F. Meek, resigned.

Union Pacific.—C. F. Resseguie, late of the C. B. & Q., has been appointed Superintendent of the Idaho Division.

Employment.

WANTED.—A position of trust by a steady competent man in the car department of a railroad company. Has had twenty years experience, and has held responsible positions. Thoroughly understands machinery appertaining to car work, and has first-class recommendations. Address "Car Builder," office of NATIONAL CAR AND LOCOMOTIVE BUILDER.